Towards a Framework for Sustainability in UK Retail Architecture

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This work is dedicated to the memory of Jackie Kitchen who taught me about responsibility to society and the environment as a child. I hope that through this work, those values of respect will be propagated for the benefit of all our children and future generations to come.

Abstract

The issues of environmental sustainability; fossil fuel use, resource use and pollution have until very recently remained a low priority to the vast majority of retail clients. The traditional barriers of capital cost, lack of precedent and perceived need have been replaced by the more urgent drivers of brand management and business risk. This emerging client need for more sustainable buildings requires that a methodology is adopted to enhance the end product for all stakeholders whilst avoiding possible criticism of "greenwash". However, despite the number of initiatives available, environmental analysis of retail projects in the UK have been limited to site environmental impact assessment required for planning approval and written sustainability statements submitted as supporting information, and only required for large projects and at the discretion of the planning authority. These documents are rarely referred to once the planning stage has been passed and substitution of materials form routine cost saving measures through the Design and Build procurement route. Moreover, the layered nature of speculative development; where the client is a developer aiming to sell to an investor and the tenant is responsible for their own fit-out and plant, limits the level of innovation and continuity of thought between all stakeholders.

This research was therefore conceived to address the need for an appropriate methodology to ensure that sustainability is considered in the design of retail facilities. The aim was to develop a framework methodology for incorporating sustainability in the design, construction and management of retail facilities.

The following objectives were pursued: (a) To define the criteria of sustainability in architecture through literature review; (b) to understand the specific problems associated with sustainability in retail architecture through literature review, case study interviews and survey data; (c) to assess the extent to which existing tools satisfy the criteria for sustainability; (d) to develop a framework using the findings of the research through design and action research strategy and test the resulting framework though industry dissemination and hypothetical case studies.

The results of the research outlined by the objectives above resulted in the development of a framework methodology. Using intuitive discursive analysis as the most readily adaptable process with the use of risk identification and mitigation as a design management technique, the resulting framework provides a matrix based documentation tool to facilitate development of the brief from the design of the facility, through procurement stages and providing a plan for sustainable management at handover of the facility to the client. The research concludes that improving the sustainability of retail facilities is a real possibility but that it is also dependant on client acceptance of responsibility to wider society and the environment.

This research supports the need for a structured and integrated approach for design, development and delivery of retail facilities at all scales and how the interface between shell development and retail tenant is critical to real improvements in sustainability. The developed framework methodology requires further testing and refinement in a wider variety of applications to fully explore the potential benefits to be gained.

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1 Introduction and Methodology

At the start of the 21st Century, sustainable agendas were largely absent from the retail brief (Toyne and Blamey, 2006). It was anticipated at that time that this situation might change during the course of the research programme. There was, however, a perceived industry need identified through experience in this field to explore how retailers might begin to take a more sustainable approach to the design of their retail facilities. This expectation of change was coupled with an acknowledgement of responsibility identified within the sponsoring organisation[1] to actively promote more sustainable practices broadly in commercial and especially retail architecture. Grounded in experience gained in retail architecture and building on research into the aesthetics of sustainability at Masters Level, the research aims to find a route towards sustainable retail design that is both practical and methodologically rigorous.

1.1 Context

The context of this research is provided by three areas; architecture and sustainability, the retail industry and environmental assessment methodology (Figure 1-1). These areas are outlined below and will be further explored by literature review in later chapters.

1.1.1 Architecture and Sustainability

The second half of the twentieth century has seen an increased awareness of environmental issues and the relationship between the built environment and global ecology. The historical development of environmentalism and sustainability in architecture stretches back to our earliest built heritage. This tradition is well documented, and the discourse has developed significantly in the last four decades of the 20th century. Precedent for best practice of environmental design has been set in offices, housing and schools (Slessor, 1997; Edwards, 1998; Hagen 2001; Vale, 1996). The commercial and retail sectors, however, have been much slower to respond to the imperative of sustainability.

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[1] Simons Design Ltd, Lincoln.

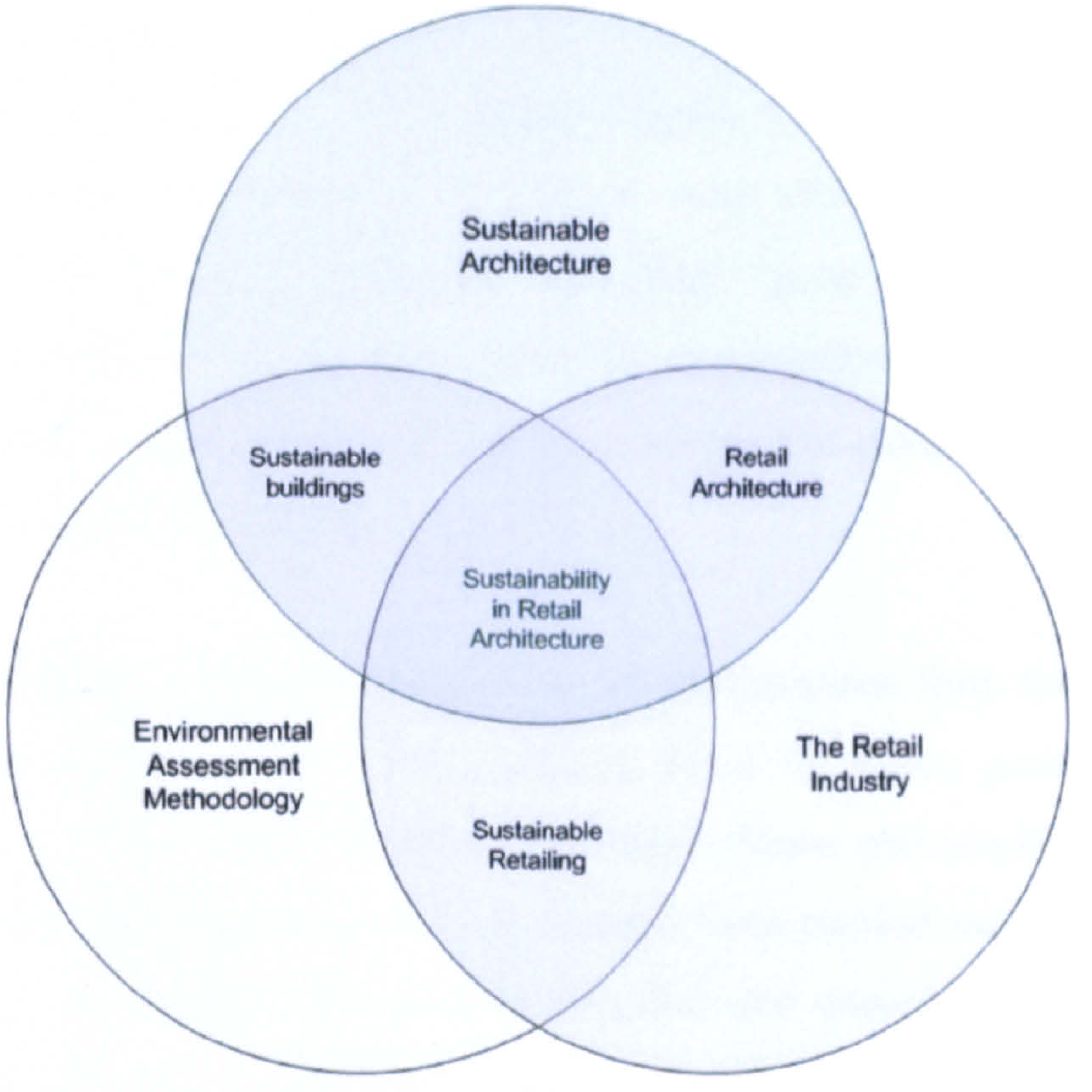


Figure 1-1 Research Context

environment

the conditions that affect the behaviour and development of;

the physical conditions that exists;

the natural world in which people, animals and plants live.

environmentalism

concerned about the natural environment and a desire to improve and protect it.

ecology

the relation of plants and living creatures to each other and to their environment;

the study of this.

sustainable

involving the use of natural products and energy in a way that does not harm the environment;

an action that can continue or be continued for a long time.

sustainability

"development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Brundtland Report 1987.

Figure 1-2 Definitions

Introduced by Goldsmith in Blueprint for Survival (1972) the Brundtland definition of *sustainability* is well rehearsed (Brundtland Report, 1987), Figure 1-2 Definitions. The literal meaning of sustainable; "*to endure; keep alive*" (OED 1997), has been surpassed by the pre-fix *sustainable* equalling "*good for the environment*". Sustainability is a function of effective environmental management. The way we have viewed the world around us through time has forced the environment to become a symbol of our cultural philosophy.

This area is complex, with a broad spectrum of philosophies from the technocentric belief in man's ability to solve the problems faced by future generations, to the ecocentric belief in the earth's ability to heal itself. These philosophies have formed the way different architectural schools of thought have tackled environmental issues through design. These have been grouped together and described as *Environmental Design*, because the design agenda is equally placed on minimising environmental impact alongside the function of the building. This has been the vehicle for a body of architectural work purporting to be environmentally superior. Contemporary environmental theory dictates that all buildings should have an agenda for sustainability within their brief regardless of aesthetic or philosophical intent. This renders 20th Century definitions of *green* or *environmental architecture* redundant as these concepts become mainstream. This change in practice is being hastened by legislation and pressure from various bodies, such as Royal Institute of British Architects (RIBA), Royal Institute of Chartered Surveyors (RICS) and Constructing Excellence.

The revised Approved Document Part L (2006) of the UK building regulations has been the subject of much speculation as they closely relate to the governments requirement to fulfil the EU directive on Energy Performance of Buildings (Madine 2004). Drafts issued in September 2005 showed that commercial sectors would have considerably more stringent regulation regarding energy consumption, which was confirmed on publication in April 2006. Although they have not been enforced until October 2006, the new regulations require considerable effort and co-ordination on the part of the design team to meet the assessment criteria may even promote the need for a new profession of energy management and sustainability consultancy. The

European Directive on Energy in Buildings (Defra, 2006; COM 2002 / 91/EC) will require that most buildings display an Operational Rating to comply with the directive as part of a Code for Sustainable Buildings, which is expected to be formally published in 2008, based on actual energy use (as opposed to theoretical design-based asset ratings). The full impact of these regulations is yet to be appreciated as again there is much speculation as to the timing of phased introduction, but the need for a very different approach for design of retail facilities is apparent. Changes to the planning system announced in April 2006 (S I 2006 no. 1063) may mean that more projects will require sustainability statements than has previously been the case, and claims made at the planning stage will be expected to be pursued through construction by Planning Authorities via conditions set out in planning approval notices.

Defining the contemporary meaning of sustainability in design to support the rationalisation of the design process could allow retail architecture to overcome the aesthetic, semantic and legislative barriers towards a consistent approach. How meanings of sustainability are understood and interpreted by the procurer and their consultants is crucial to the successful incorporation of these principles into design projects. Conceptual criteria for the understanding of sustainability must be defined to ensure consistent use of terminology. This process will be approached through literature review and logical argumentation and will form the body of chapter 2.

1.1.2 The Retail Industry

The impact of energy use of the retail industry in manufacture, transportation and in retail facilities is global. Reducing resource degradation and the impact of waste disposal requires a reduction in the consumption of goods which is at odds with the principles of the commercial world. New mixed use developments with retail content are increasingly encouraged to report on sustainability strategy via the UK planning system. At the opposite end of the scale, high-street chains and independent retailers who's continue to proceed with little consideration of the issues. UK retailing was responsible for 1.7 billion tonnes of C02 output in 2004, an increase of 52.5% over the previous ten years (National Statistics Office, 2006). Whilst this only represents 0.7% of the total output of the UK, it is about the same as the annual output for education. The design and procurement of retail facilities should be carried out with sustainability as part of the brief, but it is apparent that historically this has little or no significance for many retail procurers.

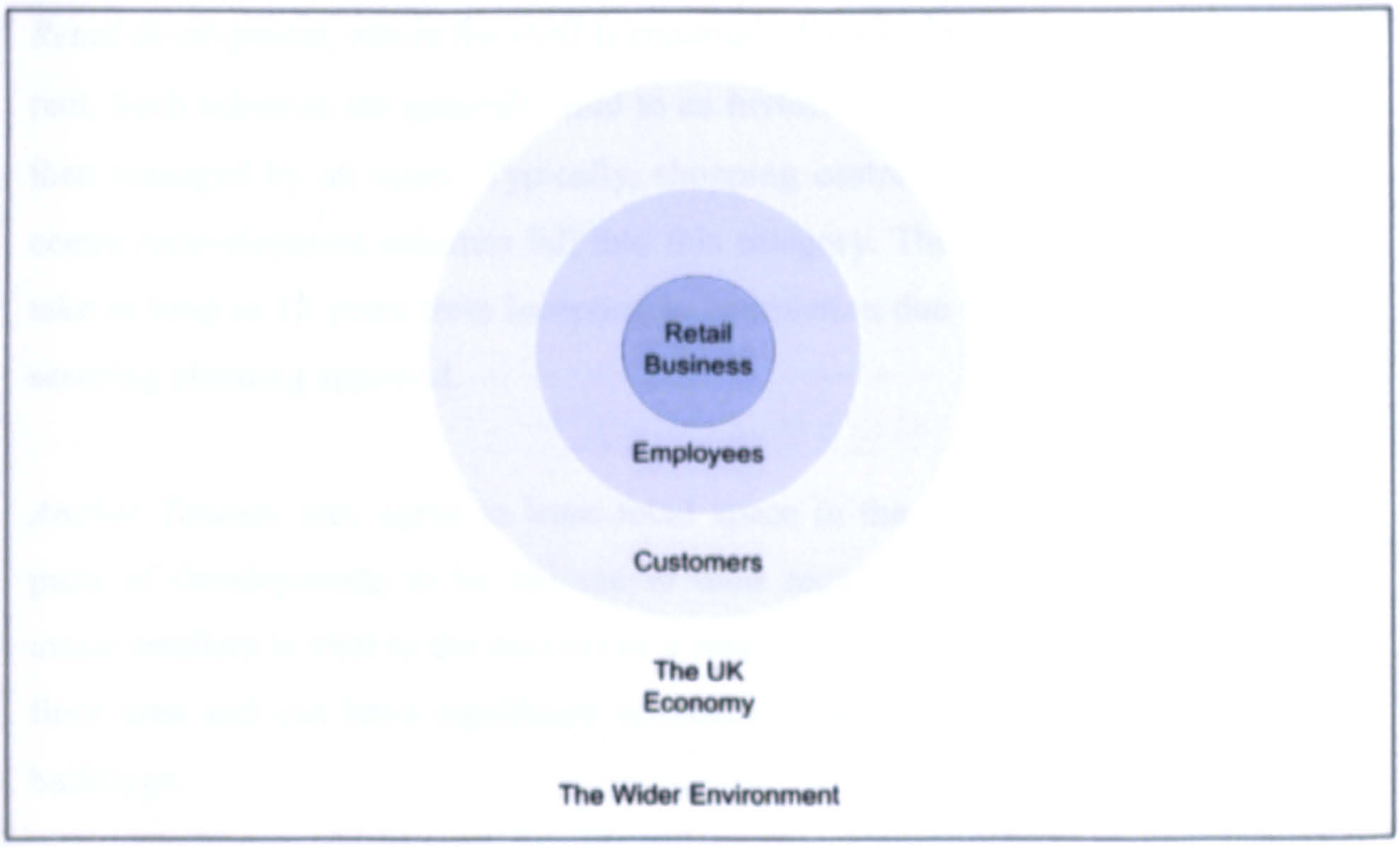


Figure 1-3 Retail stakeholder groups

In defining the retail industry three stakeholder groups are demonstrated, individual retail businesses, their direct customers and the collective retail economy which includes retail employees and customers at large (Figure 1-3). Collectively retail could be described as the pursuit of profit from the sale of goods, and consumerism as the pursuit of goods. Therefore the retailer can be seen as the capitalist and the customer as the consumerist. Considerable depth of study has been applied to shopping and consumerist behaviours. Retailing however, has been the study of economists and their interpretation of sociologist's explanations of consumerist behaviour into potential for capitalism. The Retail construction industry accounts for a considerable amount of the construction output. UK retailers spent £3.2 billion on store design and refits in 2005 (Glaser, 2006), with over a third of a million retail outlets currently operating. Retail architecture however accounts for less than 1% of the total UK architectural workload (Mizra and Nacey, 2007). Education accounted for 7% and offices 16% in 2006.

The forms which make up the majority of the retail sector of the construction industry for a distinct hierarchy;

Retail development, where the shell is constructed with a number of units available for rent. Such schemes are generally sold to an investor or fund after completion and are then managed by an agent. Typically, shopping centres, large retail terraces or city centre redevelopment schemes fall into this category. These schemes can sometimes take as long as 10 years from inception to completion due to issues with funding and securing planning approval.

Anchor Tenants may agree to lease retail space in the early design stages allowing parts of developments to be tailored to their requirements. The presence of these major retailers is vital to the success of a retail development; they take up the largest floor area and can have significant influence over the form and appearance of the buildings.

Owner Occupier, where the building is procured by the eventual user; supermarkets, large home and DIY stores are typical of this type. These retailers are most likely to consider social and environmental impacts as they are directly answerable to their own employees and customers.

Tenants fit-out where the retailer leases a unit as a shell development or in a high street setting for use as a retail outlet. The scale and complexity of such units can vary widely and have a range of design constraints from listed building consent, tightly controlled and shared servicing arrangements and escape routes in high street locations to standardised signage and shop fronts in retail developments.

Concession fit-out is generally a part of a larger retail interior, such as those that might be found in a department store or airport retail zone. These projects can be quite small in scale and take as little as a few weeks from inception to completion. Sometime the construction phase takes place overnight allowing stores to trade for the maximum period. They are often confined in many other ways due to design constraints and servicing constraints imposed by the landlord.

Sustainability for retailers has have traditionally been about economics and growth, whilst environmental sustainability is subject to limits (Cato and Kennett, 1999). Langston and Ding (1997) make the suggestion that economic sustainability requires four main attributes; Efficiency, Investment and protection of resources, Diversification to minimize risk and External Balance between imports and exports. The subset of these two contradictory principles is sustainable development. Sustainable development in economic terms requires that well-being, or development indicators are increasing over time. Sustainable economic growth is defined by increasing gross domestic product (GDP) over time without threatened detriment caused by biophysical or social impacts. (Pearce et al 1989) This traditional concept of economic sustainability is very imprtant to the retail industry and is difficult to reconcile with social and environmental sustainability.

Although the consumer is becoming more aware of environmental issues, it could be argued that consumerism is unlikely to decline in response to that awareness, although it may be seen to change its direction. O' Brien and Harris (1991) suggest that green retailing has centred on food retailing and especially by supermarket chains and that this has been targeted in three areas; environmentally benign products, reduction and recycling of packaging and store refurbishment. This process is continually improving with the constant competition between the main chains for the top placing by organisations such as the Green Consumer Guide (2006).

Retail projects are driven by economic pressure to open quickly, and competition, branding and fashion demand regular renewal of visual concept in as little as five years. This linear process may not offer retailers the best long-term value. The design team conventionally develops solutions using briefing requirements but it has not been common practice for the value judgments made to ensure value, programme and quality are acceptable to be fully recorded unless expressly required by a report of the design process to demonstrate the value they require from their building. Communication barriers between the design team and store management also hinder efficiency. Perceived savings at the time of construction lead to unsustainable development with large long-term running and disposal costs. Retailers have largely ignored this problem in the past in favour of short-term revenue from sales of their products or sale of their business.

Evidence of global warming and the effects of extreme weather events are increasingly significant factors on our daily lives and prominent in the media. Despite conflicting theories on cause, these events cannot be ignored and will have a direct and major effect on the service sector, especially those whose business involves comparison good such as clothes and household items. These retailers will be increasingly required to streamline the overheads of their businesses whilst competing in an ever more challenging market. Global warming is not the only environmental threat to construction of retail facilities. Pressure on the international oil market and the consequential cost of construction materials affects the cost of building and energy in use. Disposal of waste to landfill is increasingly controlled by the waste act and landfill tax (Defra, 2006), demanding steps be taken to reduce, re-use and recycle in the fast changing world of retail interiors.

In response to the imperative of sustainability, business in the 21st Century has begun to establish a protocol for stating an ethical position through *Corporate Social Responsibility Policy*. Defined as;

> *"...a concept whereby companies integrate social and environmental concerns into their business operations and in their interaction with their stakeholders on a voluntary basis."*
> (EU 2001).

This protocol requires businesses to go beyond legal obligations for the benefit of staff, and external stakeholders, including the environment. The EU recommend the inclusion of the following areas; Human resources management, Health and safety at work, Change management, Environmental impact management, Local communities, Business partners, suppliers and consumers, Human rights and Global environmental concerns. This concept of *Corporate Social Responsibility* (CSR) combines moral imperative with commercial need for economic sustainability to improve both the company as an employer and a deliverer of goods or services and its impact on direct and external stakeholders.

Recognising the need for such policy and implementing it through management and governance of policy being taken by employees is an evolutionary journey that businesses initiate from within. The voluntary nature of the concept means that it cannot be forced upon a company. Increasingly stringent regulations however, force the company to continually reconsider what is required to go beyond legal obligations. Research into the extent such policies have on economic performance are limited, but the Dow Jones Sustainable Index launched in 1999 has shown increased growth against their Global Index (2006), as has the FTSE 4 Good (2006) launched in 2001, both to support Socially Responsible Investment (SRI).

As CSR becomes a part of corporate strategic planning, it is apparent that the facilities used by business must also incorporate these policies into their fabric. Multinational and major UK companies generally use a report format to disseminate their performance, but a definitive procedure is required to allow fair comparison of performance between companies. The social aspects are being measured by bodies such and the Department of Trade and Industry's "50 Best Companies to work for in the UK" survey of employees. The need for research into this area has been identified by Warhurst (1998) and a global methodology is still to be agreed, developments would appear to be driven more by industry and their business need for accountability to stakeholders. The individual organisations involved in the construction industry also have their own CSR policies to maintain, and it is significant for these to uphold their own values when working for building procurers. Retailers who take advantage of the opportunity to improve their image, overhead margins and quality of service in this way will put themselves at a significant advantage as customer spending declines. In such as economic climate the retail industry will be forced to change their behaviour as neglecting such action will eventually present a business risk. These drivers for change must be assumed to affect the procurement of retail facilities. The development of the retail brief to include sustainability could have incremental potential to reduce the environmental impact of retailing as an industry.

Chapter 3 will develop further definitions of retail architecture through literature review and seek to understand how sustainability as defined in chapter 2 can be measured.

1.1.3 Environmental Evaluation

Environmental analysis and evaluation has been applied to a variety of environmental planning and policy decision-making problems. In the UK, these methods have been established since the 1960's but have become more commonly used since the 1980's. Three groups of evaluation methods exist;

1. Implicit, objective methods of cost benefit analysis and whole life costing, using actual monetary value. These methods allow the procurement team to evaluate capital against revenue costs, to compare alternative proposals or meet requirements.

2. Explicit, subjective methods of weighted analysis such as social and environmental impact and life cycle costing compares the value of criteria either by assigning monetary value or ranking to compare alternative proposals.

3. Combined methods where both methods of analysis are used together to give a comparative quotient.

Putting a value to environmental resources has established a method of comparison between the existing state of the environment and interventions upon it. Environmental valuation methods can be applied to projects where sustainable development is the intended result. A major issue in traditional environmental economics is the "monetization" (Pearce et al, 1989) of the environment. This has been the easiest way to compare projects, or the relative benefits of an action against inaction. Langston and Ding (1997) have considered the various techniques used in environmental evaluation by economists. They suggest that it is often possible to use more than one technique and that they should be considered as complimentary methods. They note that observed market behaviour is often more popular than surveyed data as it is less open to subjectivity and bias. Environmental evaluation has traditionally been carried out on complete design schemes subject to planning policy or in competition. Evaluation methods have been employed in a variety of disciplines such as product design, land use planning and PFI bids; however, their use has been limited due to the complex and time consuming calculations necessary. They have recently been made more accessible to the design community by their availability on web-based tools, but examples of use remain limited in the retail sector. Environmental decision support modelling which uses very similar techniques is a relatively new approach and has not been tested in the field of retail design. The formalisation of an environmental evaluation system could radically improve design management for sustainability and chapter 4 will pursue an understanding of this area through literature review and experimental application of existing tools in retail architecture.

1.2 Problem Statement

Summarised here are the main problems to be addressed;

1. The impact of design and construction on the environment must be addressed by all construction professionals and not limited to specialist fields and this requires a clear definition of what constitutes sustainability.
2. Retailers have been belatedly responsive to environmental issues and will increasingly be required by their direct stakeholders to recover this delay. What constitutes sustainable retail architecture must be defined to enable this move to be effective.
3. Existing environmental evaluation methods and tools are under-utilised and evaluation that is carried out may be inconsistent or misleading. Clear methodology must be established to enable the process.
4. Existing communication, technological and financial barriers to sustainability must be broken down and the process of managing sustainability through the stages of design, procurement, operation and maintenance to ensure the consistency of claims must be formulated.
5. The process of change in retailers' opinions and motives must be understood and utilised to ensure that sustainability is the result rather than supposition or deception caused by unrealistic or unfounded claims.

These problems are drawn fro experience and observation in retail architecture. Chapters 2 to 5 will develop the problems faced by the design and construction industry in their attempts to develop sustainable solutions for their retail clients. This will be demonstrated by definition, measurement and application to observe and reflect on the context of the research. This context will demonstrate the need for an approach for the management of the process to design and construct sustainable retail facilities. Challenging these problems leads to the proposal that a practical and adoptable method to address and evaluate environmental performance against economic performance could help to resolve this paradox. This will take the form of a design methodology framework to be applied in retail architecture.

1.2.1 Research questions

The contextual chapters set about reflecting on and answering a number of preliminary questions in relation to the problem statement.

1. What is sustainability?

What are the principles of environmentalism and sustainability and how can these be conceptualised?

2. What is sustainable Architecture?

What is the relationship between environmentalism and sustainability in architecture? What are the criteria for sustainability in architecture?

3. What is sustainable retail architecture?

How can the paradox between sustainability and commercial exploitation be overcome through design and construction of retail facilities? How does this conceptual framework correspond with the actual creation and use of retail facilities? How can the drivers for change in retailing be applied to the procurement of retail facilities aid increasing interest in sustainability?

4. How can sustainable retail architecture be demonstrated using environmental analysis methodologies?

What can analysis offer to the procurer (economic aspect)? What can analysis offer to the environment (environmental aspect)? What can analysis offer to the customer/employee/third party (social aspect)? How can the best and most applicable parts of existing methods be utilised into a new format? Are finite measures a limitation to the virtuous circle required to maintain sustainable development? Can greater success be achieved through self-initiated target led approach or competitive indexing? Can a multi-form multi-criteria approach be developed that is understandable and useable, whilst still being credible? Which method or combination of methods or transferred method could work and how should it be presented for the procurer audience? Can sustainability be ensured in design, procurement, operation and maintenance by the development of a design methodology framework? How can the problems of time, budget and knowledge/experience in project teams be overcome? How can the problems of managing and demonstrating sustainability in the construction industry be addressed?

5. Can a design methodology framework meet the needs of sustainable retail architecture?

Can this framework support better design decision-making for sustainable retail environments in reality? How can positive design decisions at the design stages be supported at vulnerable later stages? Can the conceptual framework be used to formulate a model for analysis? To what extent can viewing the whole life of the retail facility including the lifecycle of the framework contribute to better quality and more sustainable environments? To what extent can the marketing and corporate social responsibility aspect be incorporated into the process? Is it necessary for a major procurer led change in the way retail facilities are developed and procured to enable sustainable design and management of premises or can consultant led design team procedure and management be sufficiently effective? To what extent can the procurer's CR policy be used as a generator of requirements? How can the analysis be readily, accepted, understood and used by all the stakeholders to form the virtuous circle necessitated by the principle of sustainability?

Table 1-1 Research Questions to the development of the objectives through out the entire thesis.

Research questions		Objectives
What is sustainability?	What are the principles of environmentalism? What are the principles of sustainability?	To understand the theoretical development of environmentalism and sustainability in architecture and construction.
What is sustainable architecture?	What is the relationship between environmentalism and sustainability in architecture? What are the criteria for sustainability in architecture?	To clearly illustrate the defining principles of sustainability in architecture.
What is sustainable retail architecture?	How can the paradox between sustainability and commercial exploitation be overcome through design and construction of retail facilities? How does this conceptual framework correspond with the actual creation and use of retail facilities? How can the drivers for change in retailing be applied to the procurement of retail facilities aid increasing interest in sustainability?	To understand the theoretical background of retailing, the performance indicators specific to the retail industry and define the performance indicators of sustainable retail architecture. To understand the specific problems experienced in retail construction relating to the application of environmental principles and demonstrate current practice in the design and construction of retail facilities.
How can sustainable retail architecture be demonstrated?	What can analysis offer to the procurer (economic aspect)? What can analysis offer to the environment (environmental aspect)? What can analysis offer to the customer/employee/third party (social aspect)? How can the best and most applicable parts of existing methods be utilised into a new format? Are finite measures a limitation to the virtuous circle required to maintain sustainable development? Can greater success be achieved through self-initiated target led approach or competitive indexing? Can a multi-form multi-criteria approach be developed that is understandable and useable, whilst still being credible?	To review the potential use of existing environmental evaluation methodologies and how they demonstrate sustainability To review how these tools can be applied to the particular situation of retail fit-out projects.

	Which method or combination of methods or transferred method could work and how should it be presented for the procurer audience? Can sustainability be ensured in design, procurement, operation and maintenance by the development of a design methodology framework? How can the problems of time, budget and knowledge/experience in project teams be overcome? How can the problems of managing and demonstrating sustainability in the construction industry be addressed?	To develop a theoretical framework using the accumulated criteria and knowledge specifically for the retail industry
Can a design methodology framework meet the needs of sustainable retail architecture?	Can this framework support better design decision-making for sustainable retail environments in reality? How can positive design decisions at the design stages be supported at vulnerable later stages? Can the conceptual framework be used to formulate a model for analysis? To what extent can viewing the whole life of the retail facility including the lifecycle of the framework contribute to better quality and more sustainable environments? To what extent can the marketing and corporate social responsibility aspect be incorporated into the process? Is it necessary for a major procurer led change in the way retail facilities are developed and procured to enable sustainable design and management of premises or can consultant led design team procedure and management be sufficiently effective? To what extent can the procurer's CR policy be used as a generator of requirements? How can the analysis be readily, accepted, understood and used by all the stakeholders to form the virtuous circle necessitated by the principle of sustainability?	To test the design methodology framework using historic, simulation and case study project data. To evaluate the design methodology framework both as a concept and tool in the field of industry application and academic standing.

Table 1-1 Research Questions

1.2.2 Aims and Objectives

The aim of this research therefore is to demonstrate that the provision of sustainable retail architecture is possible through the development of a design methodology framework that will enable improved sustainability whilst still meeting the retailer's functional and economic performance requirements.

The design methodology framework is to take into account existing approaches of environmental evaluation methodologies and utilise the most relevant methods. This model is to be both applicable to the retail sector and transferable to other sectors.

The following objectives will form the basis of the literature review, reflection and observation to answer the research questions and achieve the stated aim;

1. To understand the theoretical development of environmentalism and sustainability in architecture and construction.

2. To clearly illustrate the defining principles of sustainability in architecture.

3. To understand the theoretical background of retailing, the performance indicators specific to the retail industry and define the performance indicators of sustainable retail architecture

4. To review the potential use of existing environmental evaluation methodologies and how they can be applied to the particular situation of retail fit-out projects.

5. To understand the specific problems experienced in retail construction relating to the application of environmental principles and demonstrate current practice in the design and construction of retail facilities.

6. To develop a theoretical design methodology framework using the accumulated criteria and knowledge specifically for the retail industry

7. To test the design methodology framework using historic, simulation and case study project data in order to demonstrate its validity.

8. To evaluate the design methodology framework both as a concept and tool in the field of industry application and academic standing.

1.3 Research Design

Precedent for this form of research design is rooted in the principles of Lewin (1942) and the development of *Change Theory*. Coghlan and Brannick (2001) define this form of research as an individual (the researcher) engaged in a reflective study of professional practice within a system, in this case the design of retail architecture (Figure 1-4). Whilst there is a relationship with research which studies the potential for large scale transformational change, this is not the aim of the research design. It seeks rather to provide a basis for methodology to support the impending change. Therefore precedent can be found in experiential learning and transformative research methodology (Kolb,1984; Taylor, 1998; Swandt, 2005) This research is also linked to the idea of pragmatic *Action Research* (Attherton, 2005), which would be apparent in the implementation of the change to professional practice that would be brought about by wide-scale adoption of a new methodology. Both these areas are beyond the scope of this research but might be seen as further research.

1.3.1 Epistemology and Theoretical perspective

The theoretical perspective that will be employed can best be described *Inductive* (Creswell, 2003). By seeking understanding and knowledge of the subject in this interpretive manner, allows for the perceptions and preconceptions of the researcher to be examined without the need for a hypothesis. This principle is defined by referential reflexivity by May (1998) whereby the ontological structures existing within an organisation are understood by the researcher, but must be rigorously explored to develop a solution to perceived problem. Whilst suiting the nature of the general subject area, this methodology does not conform to a traditional system of enquiry, that is to say that it is neither wholly qualitative nor quantitative. As such it is within the continuum between objective and subjective epistemologies that is common to *technical and practical research* outlined by O'Leary (2004). Creswell (2003) acknowledges that this lead to a methodology that is less well established in the literature but has developed from the work of Kolb (1984), which explores experiential learning.

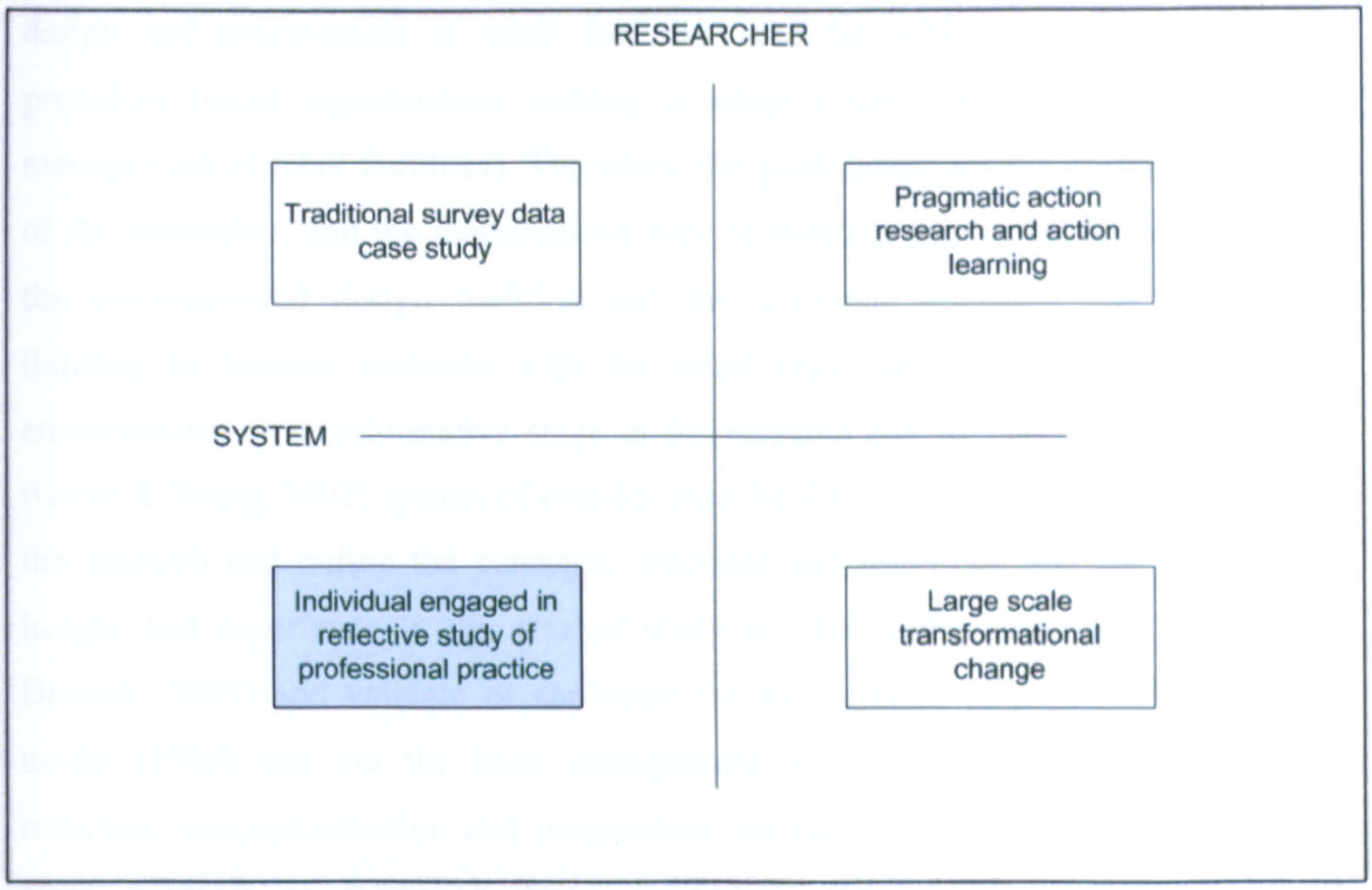


Figure 1-4 Researcher/system relationship

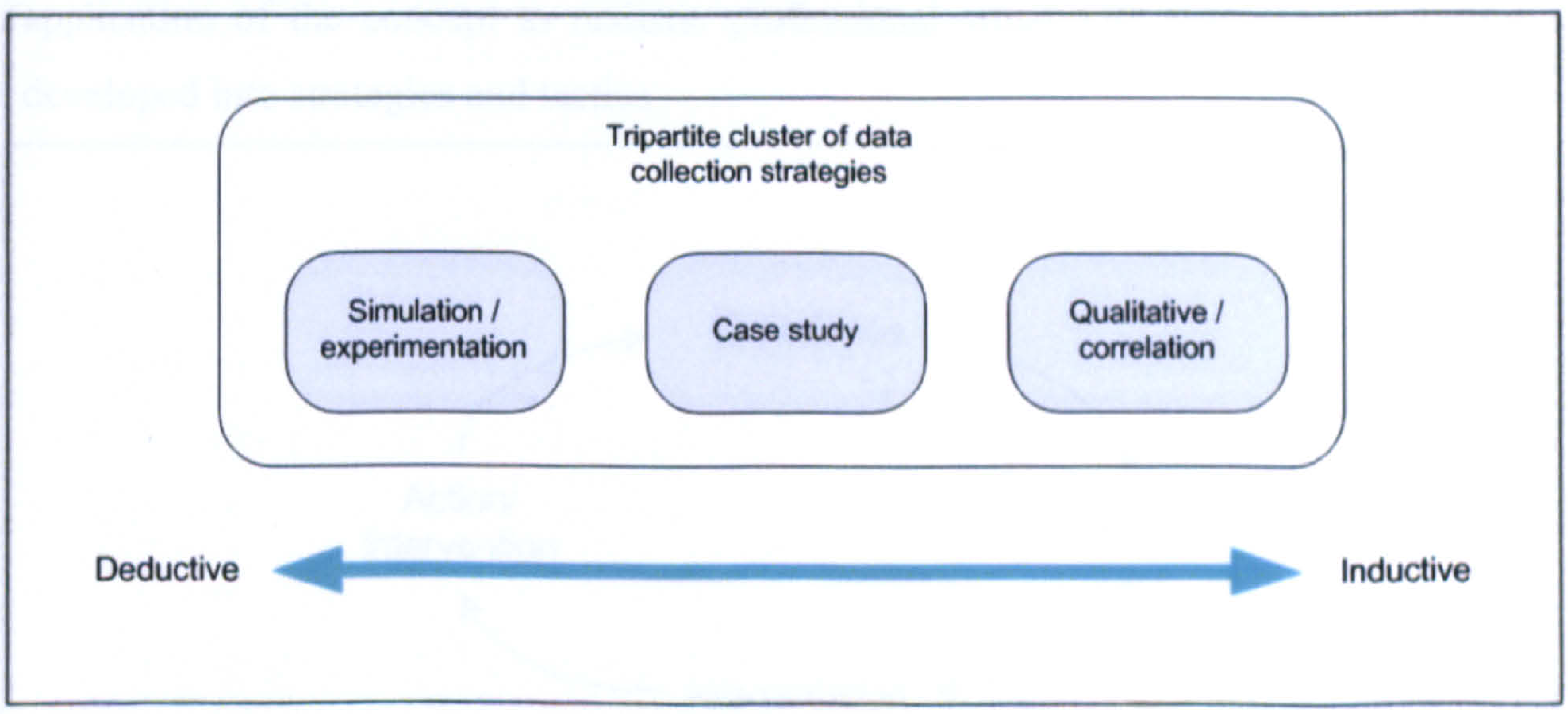


Figure 1-5 Theoretical continuum

The research questions and aims posed are essentially drawn from a perceived need to promote change within an organisation and to bring marginalized ways of thinking inherent in environmentalist tradition into mainstream retail architecture. O'Leary describes this approach as *Participatory* and *Emancipatory* action research. Taylor (1998) holds that this is a central aim in *Transformative* study. In the case of this thesis, the researcher is examining from within the organisation and along with professional peers, is examining both the procedure of the organisation (architectural design and procurement of retail facilities) and the subject of the organisations procedure (retail organisations seeking to adopt a new philosophy in design and management of retail facilities). Therefore, the participants are the professional peers of the researcher, and the marginalized way of thinking that is to be emancipated is the environmental design tradition and the corporate approach that allows this thinking to become endemic with the retail organisation. However, before this emancipatory or transformative stage in the research can be reached, a *Naturalistic* (Groat & Wang, 2002) system of enquiry must be followed to establish the context of the research and define the concepts, practices and traditions that the researcher's insight and experience in the area of study or "Pre-understanding" (Coghlan and Branick, 2001) and validate or challenge the assumptions arising. Kolb's learning model (1984) sets out the basic arrangement of this research where experience, refection, conceptualisation and pragmatism are carried out in a sequential journey from problem identification from experience through literature review and observation, to assimilation of a proposed design methodology framework and application of the concept to realistic professional situations. This cycle is further developed into strategies and tactics

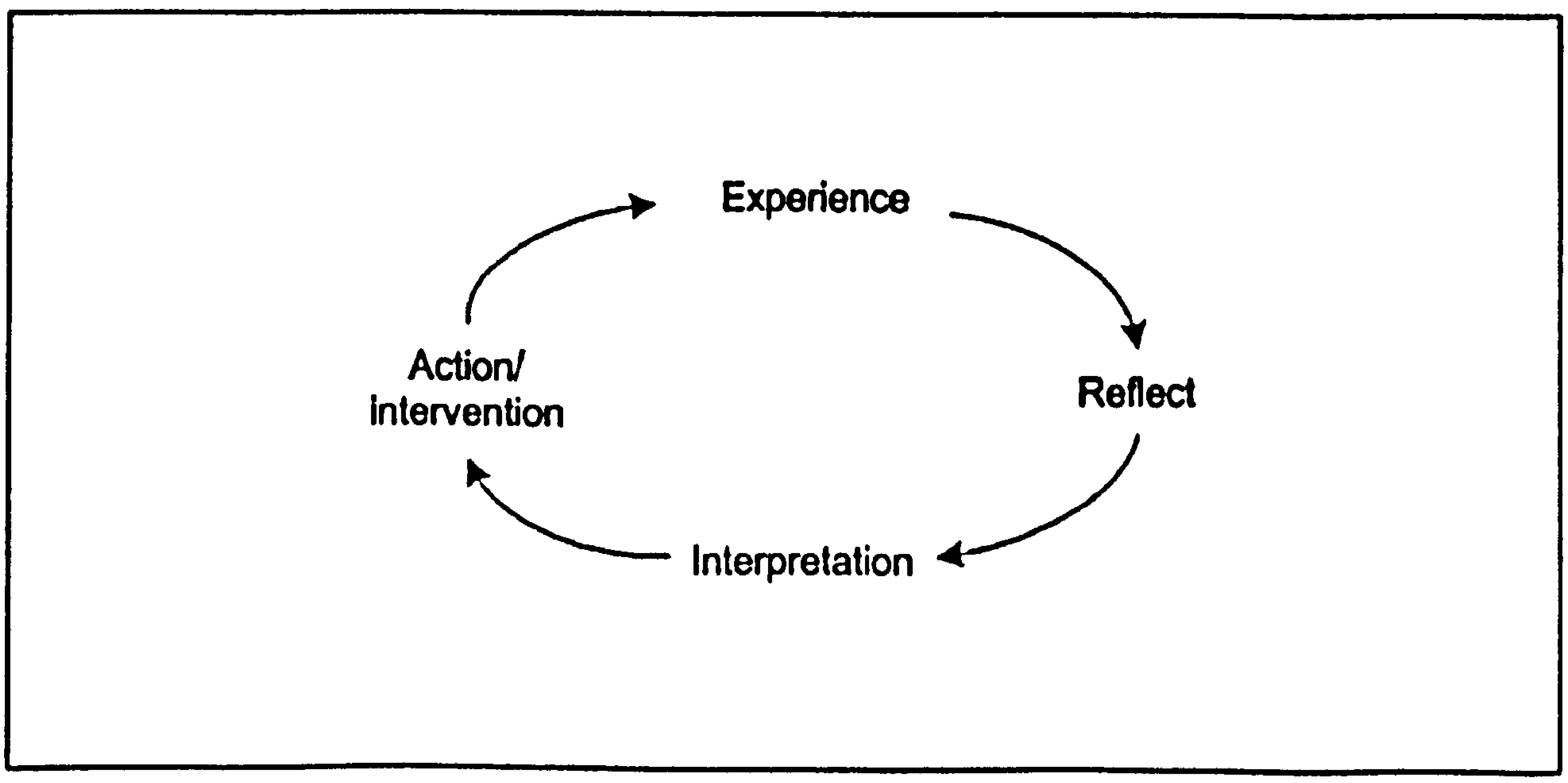


Figure 1-6 Experiential Learning

1.3.2 Strategy and tactics

The three distinct but overlapping areas of context (Figure 1-1) would seem to lend them particularly to a triangulation of methodology to balance the economic, social and environmental epistemologies and their contrasting traditional systems of enquiry. This follows the *tripartite cluster* paradigmatic model proposed by Groat and Wang (2002). Traditionally economic research requires experimental or simulation strategies, social research requires case study or qualitative strategies and environmental research requires qualitative or correlation strategies. This in turn leads to employment of diverse strategy to investigate the research questions. Therefore the research strategies are a mixed approach which could be broadly termed as *Sequential Transformative Strategy* (Creswell, 2003) to fieldwork data where each study is carried out as a consequence of the findings of the preceding study and each seeks to obtain specific information to build up a larger picture in order to reach a stated aim (Figure 1-7). Specific tactics are employed for each investigation as necessary to the information that is being sought and these therefore may be drawn from a range of epistemologies. The strategy and tactics employed in these investigations will be detailed in the appropriate chapters however an outline description is given in (Table 1-2 Strategic Research plan).

As a holistic view to the problems of design and construction of retail facilities that seeks to understand the phenomena that surround the procurement of retail projects through direct observation in the field, this research by nature involves contexts which demand different research strategies some of which are quantitative and others qualitative. Despite the tendency towards standardisation in concept designs, materials specified, plan forms and control systems used, each retail facility is unique in its exact geographical context, the form, structure and orientation of each situation and shell building can vary widely furthermore they are rarely procured simultaneously. The design process in retail architecture is driven primarily by constraints and requirements posed by the various stakeholders (landlord, developer, local authority, fire officer etc), alongside an acknowledged programme and budget. Architects working in this field are perhaps less likely to follow theoretical or aesthetic paradigms for their retail clients as the approach to design that is preferred is essentially functionalist and the design problems specific to each project are dealt with as and when they arise within the time, quality and cost parameters and material and aesthetic guidelines set out by the retailer. It can be assumed that the procurement teams will take experience and learning from one project to the next and transfer this learning between retail clients, however this process is unlikely to managed in a structured manner (Bibby, 2003).

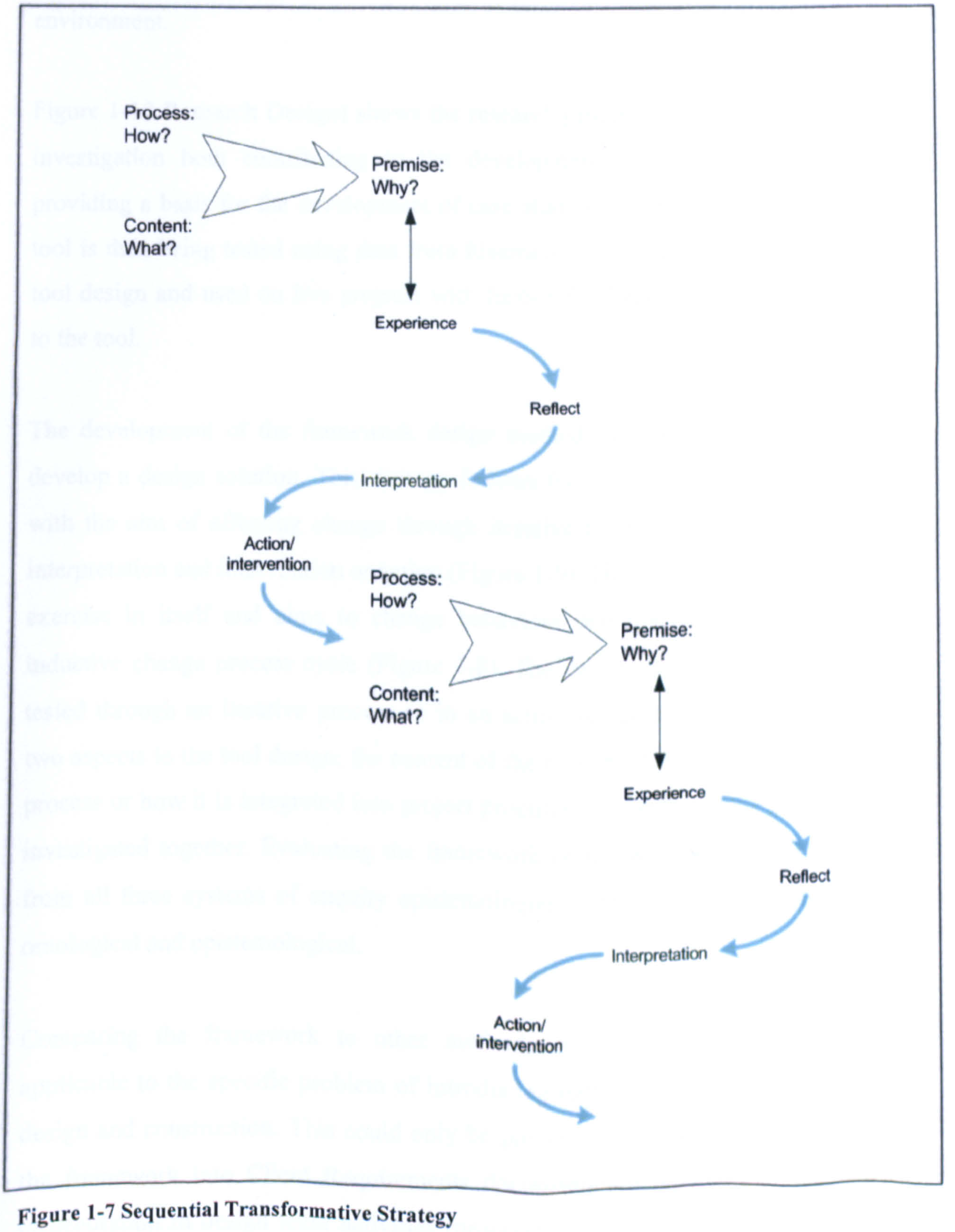


Figure 1-7 Sequential Transformative Strategy

demonstrate learning and improvement. Accumulation of data of comparable case studies would allow correlation to be carried out; however this is problematic in the research programme due to constraints of case study availability.

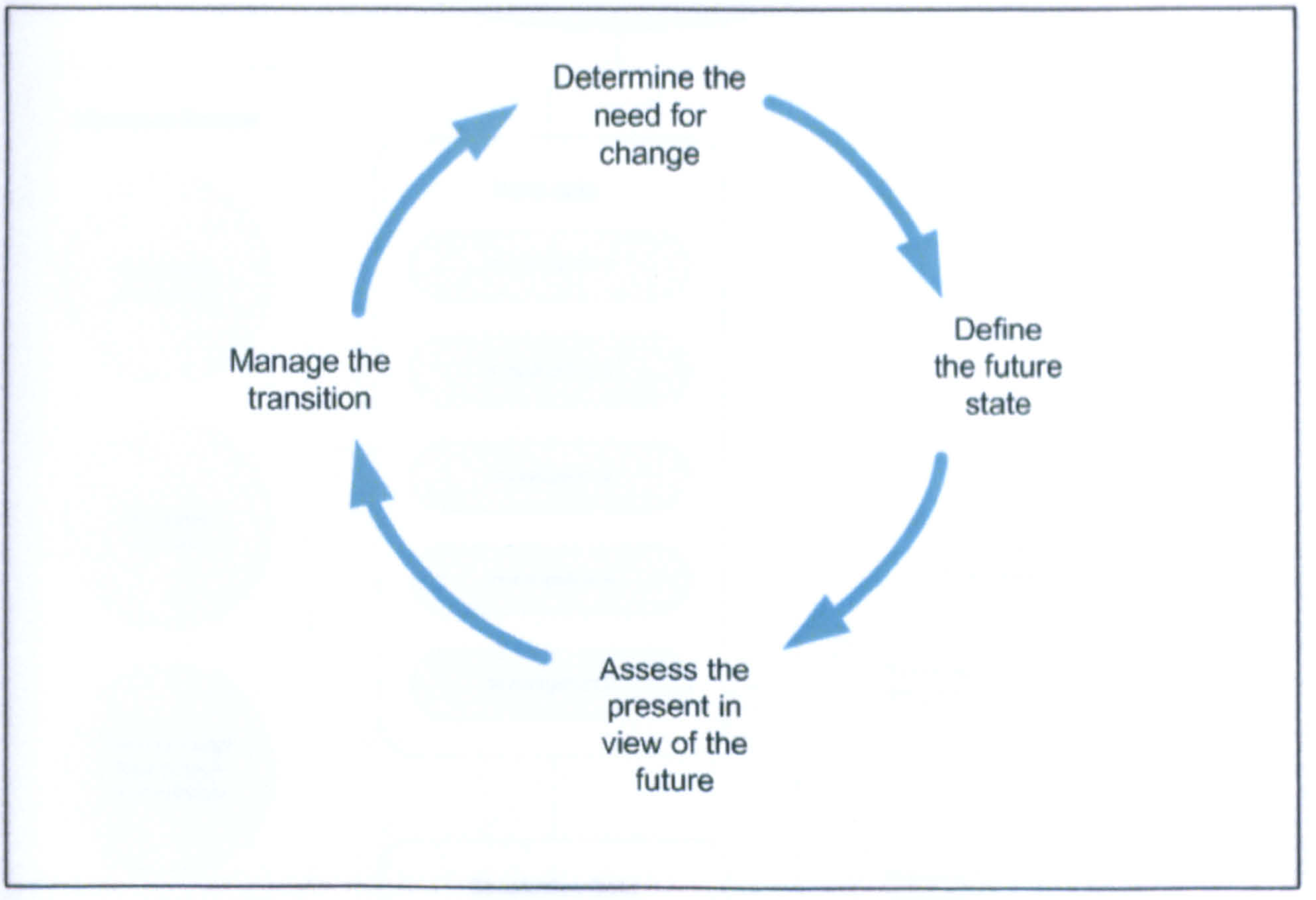


Figure 1-8 The Process of Change (from Coghlan and Brannick, 2001)

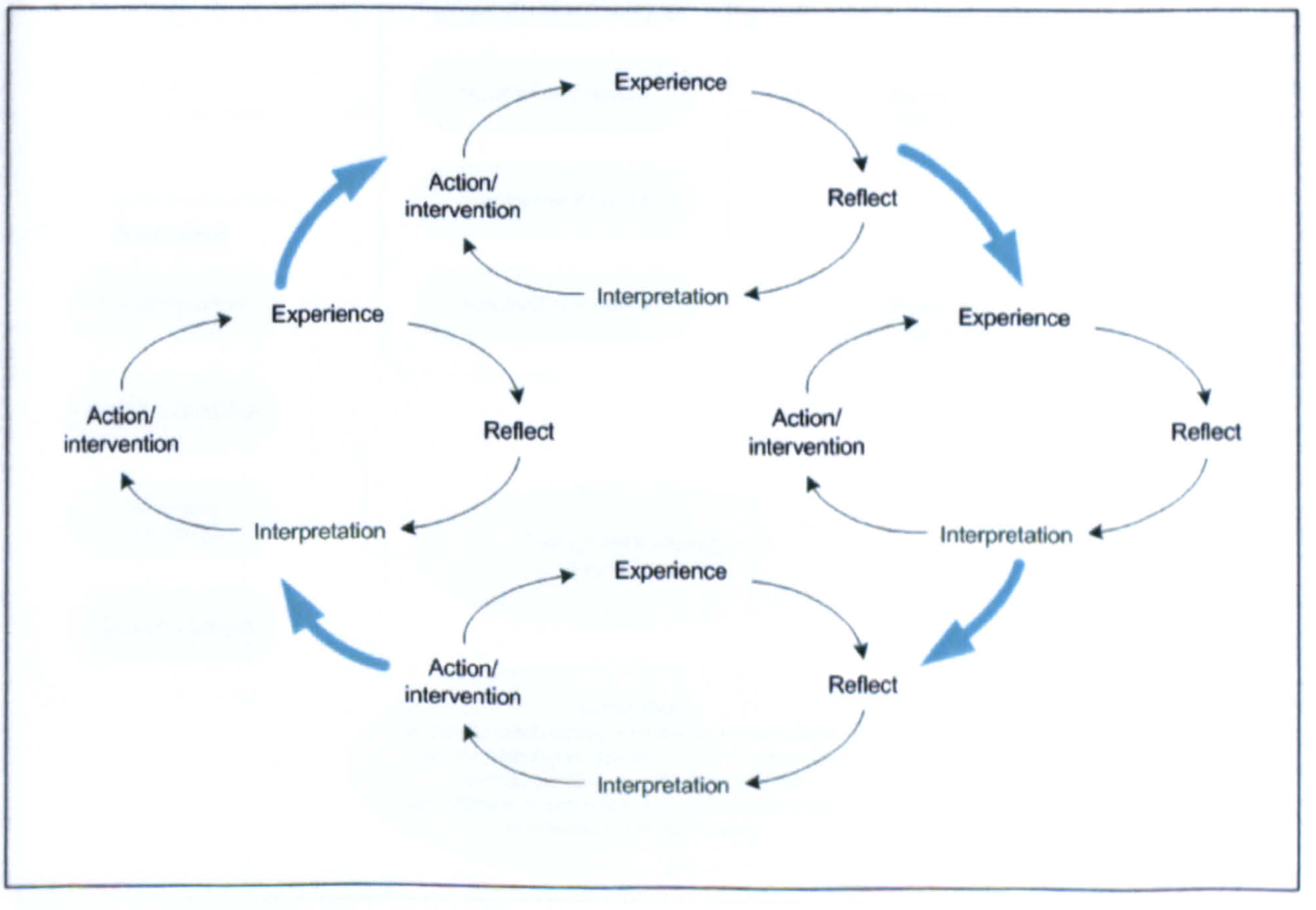


Figure 1-9 The Action Research cycle

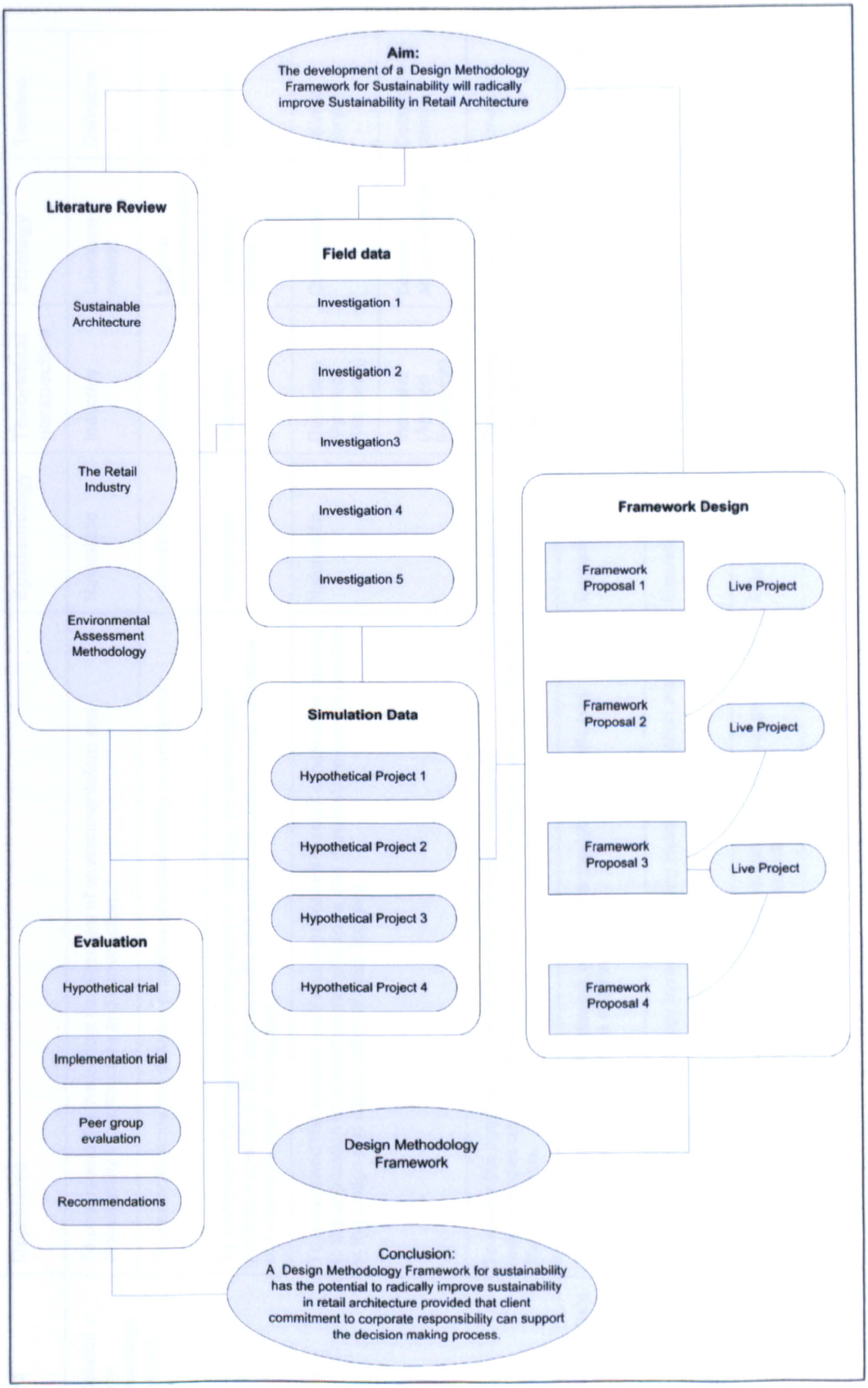


Figure 1-10 Research Design

Aims	Objectives	Epistemology	Theoretical perspective	Strategy	Tactics
To develop a design methodology framework	To understand the theoretical development of environmentalism and sustainability in architecture and construction.	Naturalistic	Inductive	Literature review	Definition
	To clearly illustrate the defining principles of sustainability in architecture.	Naturalistic	Inductive	Logical argumentation	Definition
	To understand the theoretical background of retailing, the performance indicators specific to the retail industry and define the performance indicators of sustainable retail architecture.	Naturalistic	Inductive	Literature review	Definition
	To understand the specific problems experienced in retail construction relating to the application of environmental principles and demonstrate current practice in the design and construction of retail facilities.	Naturalistic	Deductive (Applied Research)	Correlation	Opinion Surveys
			Inductive (Applied Research)	Logical argumentation	Document review
	To review the potential use of existing environmental evaluation methodologies and how they can be applied to the particular situation of retail fit-out projects.	Naturalistic	Developing and testing theory	Experimental research	Simulation
To Demonstrate that the provision of sustainable retail architecture is possible	To develop a theoretical framework using the accumulated criteria and knowledge specifically for the retail industry.	Emancipatory	Experiential Learning/ Change Theory	Content review	Live Projects as Case Studies
	To test the design methodology framework using historic, simulation and case study project data.	Emancipatory	Developing and testing theory	Summative Evaluation	Simulation (time series analysis)
	To evaluate the design methodology framework both as a concept and tool in the field of industry application and academic standing.	Emancipatory	Action Research	Process review	Evaluative survey

Table 1-2 Strategic Research plan

1.3.3 Scope

The scope of this research includes retail property generally including small shops, large stores and supermarkets, retail developments that may also include other secondary uses and larger retail distribution and storage facilities. More attention has been paid to facilities that serve the interface between the retailer and their customers and other stakeholders within the wider context of UK towns and cities. Other building uses are outside the scope of the research, but not are excluded from the application of the design methodology framework.

Industry collaboration will allow real data from ongoing projects to be utilized to test methods of analysis and a level of active research on actual projects to form case studies. This study will be limited by the real constraints of the construction industry, in that the testing of a framework based on real projects if they are available, and that the building procurer's level of co-operation and willingness to modify the design of the project in light of model results cannot be controlled for the purposes of the research. Due to the limitations of suitable retail project occurring within the timeframe of the research it is proposed that case studies from other project types are used in the iterative testing process in order to maximise the breadth and value of the findings of the iterative testing process of the design methodology framework.

The outcome of the research should provide a platform for design and construction consultants to perform an analysis for sustainability of retail architecture having fully established all the related issues and effects, and allowing building procurers to embody their CR policy into their stores to be more sustainable and socially acceptable. It is not intended that the research will produce a fully functioning model rather that it will provide the basis for the collation of further data and refinement through a greater application in the industry.

1.3.4 Research Significance

Industry need for a framework for sustainability is fundamental to the pursuance of this topic. Therefore, design consultants and project managers, retail implementation and retail fit-out and retail development design teams are intended as the audience. It will also be of interest to retailers who wish to improve their profile in sustainability and compete in an increasingly difficult climate. Although most relevant for retail, it will also be beneficial for other leisure and commercial design and construction sectors.

Published research in this area is limited, as is comparable data for environmental performance of retail facilities. Placed alongside work in analysis and measurement of built forms for environmental performance, this research will make a contribution to knowledge in methods of implementing sustainability in the broader construction industry and make an original contribution to the specific provision of sustainable retail architecture.

1.4 Structure

Chapter 2 Architecture and Sustainability will discuss the theoretical development of environmentalism and sustainability in architecture and define conceptual criteria for sustainability.

Chapter 3 The Retail Industry will develop the context of the retail industry and define criteria for sustainability in retail architecture.

Chapter 4 Environmental Assessment will review existing environmental evaluation theory and application in retail projects using hypothetical data to develop an understanding of how such tools can inform the design and construction process and meet the criteria for sustainability.

Chapter 5 Current Practice in Retail Architecture will use fieldwork data to demonstrate current practice in the design and construction of retail facilities and establish the specific problems experienced in retail construction retailing to the application of environmental principles to inform the development of the framework.

Chapter 6 Design Methodology Framework Development will consider the design criteria developed throughout the previous literature and fieldwork research chapters and develop these into a conceptual proposal. An iterative action research methodology will be used to refine the framework proposal through application on live case studies to reach a working proposal. The process of validating the conceptual framework is reported, with responses to the initial proposal and refined framework design through industry and academic review.

Chapter 7 Implementation in Retail Architecture will document the utilisation of the proposed framework design methodology. Live test cases were not forthcoming during the period of the study and simulation studies are used to test the proposal on retail forms and demonstrate the possibilities for sustainability in retail architecture. Evaluation of the content and process of the proposal is documented through survey data.

Chapter 8 Conclusions will summarise the findings of the research and contributions to knowledge and recommend further research.

2 Architecture and Sustainability

The aim of this chapter is to establish criteria for the evaluation of sustainability in architecture. This is approached with the following objectives;

1. To define the concept of sustainability and environmentalism and how this has changed through history until our current understanding in the 21st Century.
2. To review how environmentalism is interpreted in architecture.
3. To define the criteria by which sustainability will be understood for this research and how this relates to architecture.

The first objective will be approached through a literature survey of environmentalist theory. The second objective will use literature from architectural environmentalism. The third objective will develop criteria through *logical argumentation strategy* to frame a conceptual system (Groat and Wang, 2002).

2.1 A Brief History of Environmentalism

This section does not set out to recount the arguments or collate the evidence for sustainability, but rather to organize the ideas surrounding the concept and to derive from that organization, some meaning that will contribute to the framework of the whole research. This will be carried out in the form of a literature review charting the historical development of environmentalism to the present day allowing the interpretation of shifting patterns in policy and action. This will in turn inform the development of a framework for sustainability in architecture.

2.1.1 Environmental conceptualisation

In the earliest times a view of the universe existed stemming from Pagan and other religious ideas that were closely allied to nature, this Natural Magic was widespread until the Renaissance. Alongside this belief were Aristotelian science and the anthropocentric view of Medieval Cosmology, where the celestial regions encircled the Earth and Man had dominance over nature. Critically this sets out the notions of how Man relates himself to the environment, either, less than, equal to, or greater than the environment. The Scientific Revolution of the 16th Century saw a gradual shift with Natural Magic evolving into Romanticism and Aristotelian science into Newtonian Science. Two analogies developed reflecting this divergence, likening the environment to a huge biological model, and conversely, to the mechanism of a clock, or machine.

Pepper (1984) suggests that Romanticism was one of the early forms of ecological thinking, stemming from a reaction against the rational progression of science and technology in the late Victorian period. Leading up to this period, landscapes that had escaped cultivation became increasingly appreciated for the sublime qualities of their wilderness. Ideas of utopian self-sustaining communities were developed in the 19th century. Essentially romantic idealism, the idea of using ones own hands to produce food and home comforts was attractive in an increasingly mechanized society. However, the missionary zeal of this kind of environmental and social engineering was based on an idealism that had infeasibility as its basis (Borsi, 1997). A less idealist liberal movement, which concerned itself with a peaceful existence and getting back to nature persisted well into the 20th century with a major Neo-Romanticist insurgence in the 1960's and 1970's. The word Ecology, derived from the Greek *oikos* – house and *logos* – understanding, has been in use since German Biologist Ernst Haeckel first used the term in 1878 (Pope et al 1991). Ecologists study the world as a balanced system of natural forces in which no living thing exists in isolation. Ecology is the scientific study of ecosystems, not a political or philosophical viewpoint. However, ecologists have become confused with the *Deep Ecology* movement of political activists especially during the 1970's. Ecosystems are sometimes viewed with human life as an externality, contradicting the suggestion that all species are integral to the ecological balance as an argument against the protection of species and habitats against extinction. Lovelock (1979) took the principle of world ecology to an extreme level by describing the planet as a single biological entity and represents a spiritual philosophy using ecology as a hypothesis.

Between these two extremes, a separate theory developed. Pepper (1981) suggests that this middle ground is the domain of social sciences stemming from the ideas of Francis Bacon published in Novum Organum, (1620). Bacon's philosophy emphasized the belief that people are the servants and interpreters of nature, and *ampliative inference*, a technique of inductive reasoning, became the accepted method for studying nature and the objects and phenomena found therein. This ideology allowed science to become the servant of Man, providing better quality of life through improving all manner of circumstances. The application of this new social science was manifest during the industrial revolution which in turn gave rise to capitalism and widespread exploitation of natural resources.

Through Malthusian theory of population growth published in various forms in the early 1800's and Darwin's theory of natural selection published in 1859, a form of environmental *determinism* has endured where humans and animals behave in a certain way, particularly in a competing manner in order to secure survival, an idea that supports capitalism. At the same time, Darwin's ideas of balance and the interrelated nature of life on earth has supported the Gaia hypothesis of Lovelock (1979). This systems approach to the environment suggests that the whole is greater than the sum of the parts, and that the environment is an indivisible system. Despite this contradiction, Darwin and Malthus' environmental determinism have supported an intersecting ideology. These three conceptual models of Systems, Social science and Mechanisms allowed the environment to be understood in very different ways and these analogies have endured to the present day (Figure 2-1 Conceptual Models).

Interest in our relationship with the environment was re-established by a number of publications responding to damage to wildlife caused by farming techniques (Carson, 1969) and the oil crisis of the 1970's (Goldsmith, 1972; Meadows, 1972). Whilst both Goldsmith and The Club of Rome took population growth as the prime driver of imbalance in their alternative world systems, they had very different approaches for tackling the problems of the environment. The Club of Rome introduced the *technocentric* idea of a technologically optimistic society, (Meadows, 1972) one that believes that environmental problems will be solved by technological solutions. When modelled, applied technological solutions are portrayed as prolonging the period before system collapse, but not eradicating it (Meadows, 1972) leading to the conclusion that technological solutions alone will not result in environmental stability.

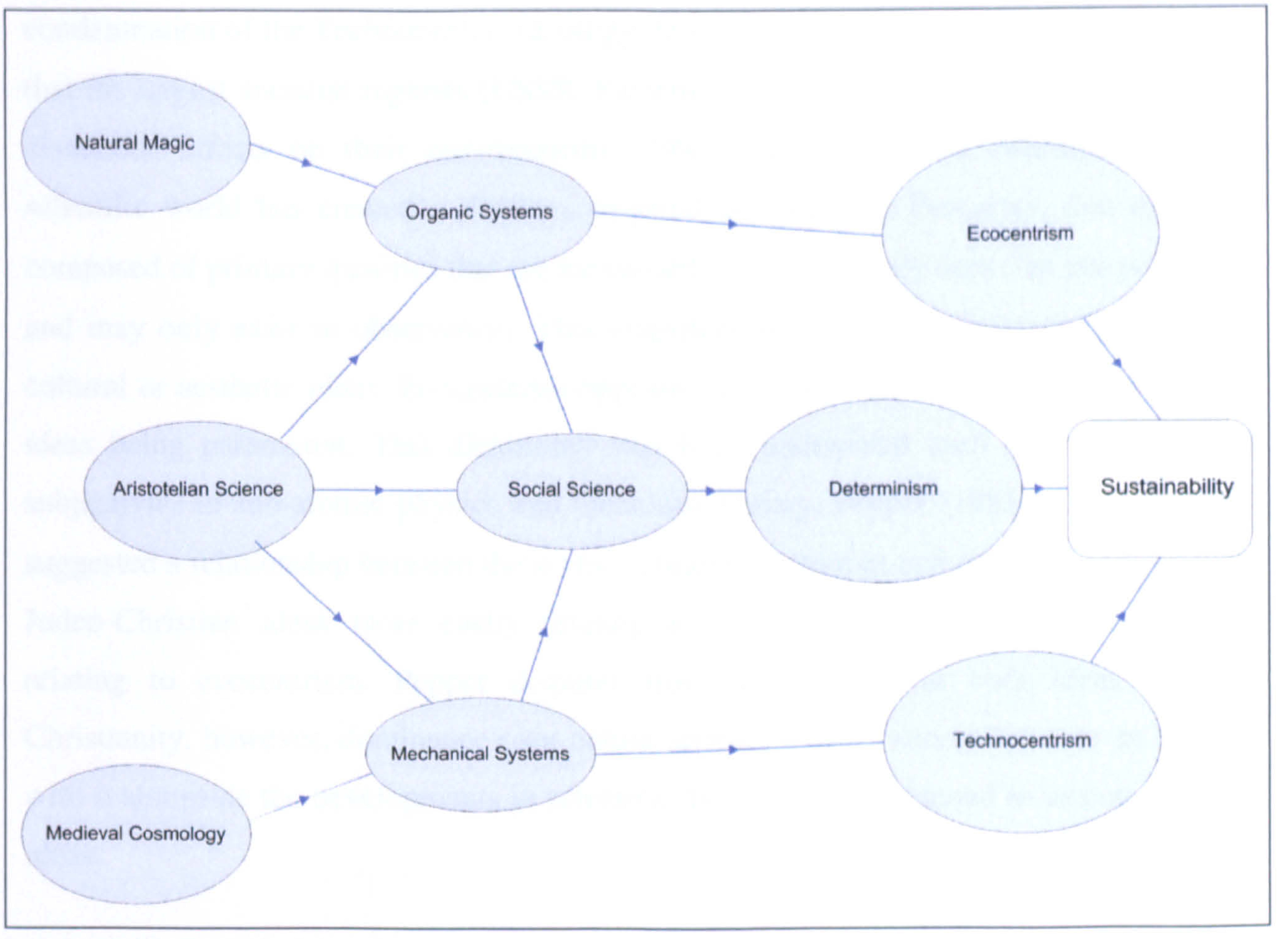


Figure 2-1 Conceptual Models

Goldsmith (1972) advocates a change to the value system of the developed world, where growth of economic supply and demand has been central to so-called stability. Real value or social accounting not economic value was the key to non-growth economy to achieve sustainability. This idea is essentially *Ecocentric* and challenges the *Technocentric* model of the world as a machine. These definitions of *technocentric* and *ecocentric* were established by O'Riordan (1981). Strong political significance is attached to these two opposing ideologies. Commoner (1992) sees the *Technocentrics* as capitalist, traditionally "right wing" and Ecocentrics as "left wing". This significance can no longer be clearly observed in the early 21st century. Pepper (1984) asserts that Technocentrism is the dominant and authoritative attitude to the environment in Western society and the one which is held by those which exercise the most power. This view according to Pepper is a result of the overriding approach of classical science that has been dominant since the 16th century. Commoner (1992) suggests that many of the worlds' ecological problems have been caused by allowing market mechanisms to override all other concerns, a criticism often made of the Thatcher Government of the 1980's and 90's. He asserts that failures in the technosphere are visited as effects upon the ecosphere, which adds further force to his condemnation of the Technocentric ideology. In order to counteract this point he suggests that the largest socialist regimes (USSR, Eastern European Nations and China) have had disastrous effects on their environments (1992). He argues that rationalism in the scientific world has created a dualism, inspired primarily by Descartes, that matter is composed of primary qualities that are measurable, and secondary ones that are subjective and may only exist in observation. This empirical science is not influenced by social, cultural or aesthetic ideas. Ecocentrism opposes this view with emotional and subjective ideas being paramount. This dichotomy was been undisputed until the resurgence of subjectivity in sub-atomic physics and Quantum Theory, Pepper (1981). O'Riordan has suggested a relationship between these environmental extremes and religion, with western Judeo-Christian ideas more easily relating to *technocentrism* and Eastern religions relating to ecocentrism. Pepper disputes this, suggesting that both ideas exist in Christianity, however, dominance over nature appears to have succeeded over an affinity with it alongside the developments in scientific thought that threatened to dispute Biblical ideas.

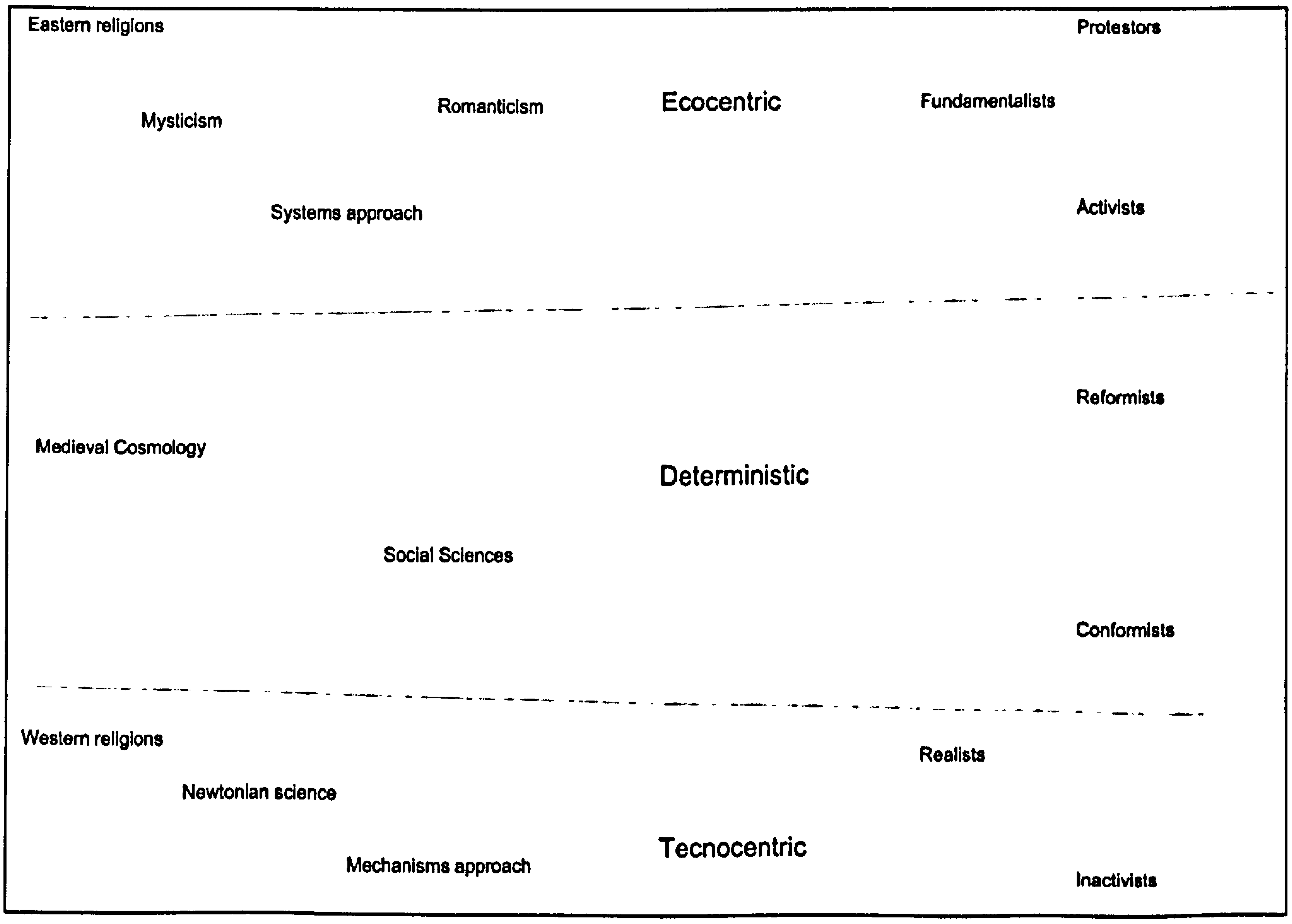


Figure 2-2 Mapping Environmentalism

Whilst the dichotomy between the technocentric and ecocentric ideologists has persisted to the present day, the deterministic central ideology has not been so well defined. Some further clarification was established by O'Riordan (1981). *Protestors* at the most ecocentric end of the scale and *Activists* and *Reformists* take the central route between the extremes. *Conformists* represent the pure technoncentrics and *Inactivists* are beyond the previous scale representing the point of view of extreme capitalists. Commoner's further divisions of *Fundamentalists* and *Realists* (1992) are placed between the ecocentric and technocentric extremes (Figure 2-2 Mapping Environmentalism).

2.1.2 Conceptual Sustainability

The concept of sustainability has been expanded from the Brundtland definition to Sustainable development prescribed by Agenda 21 at the Rio Summit in 1992 as a goal that can provide clear targets towards the needs of the concept of sustainability, which is a process (Edwards, 2005). The triangle of sustainability has evolved in literature during the late 1990's following the New York Summit of 1997, shown in Figure 2-3. Also known as the three E's of Ecology, Economy and Equity (Edwards, 2005) this model demonstrates that sustainability must balance these conflicting needs. The needs of Sustainability are shown in Figure 2-4. This balance between environmental, social and economic factors provides a way in which sustainability can be addressed.

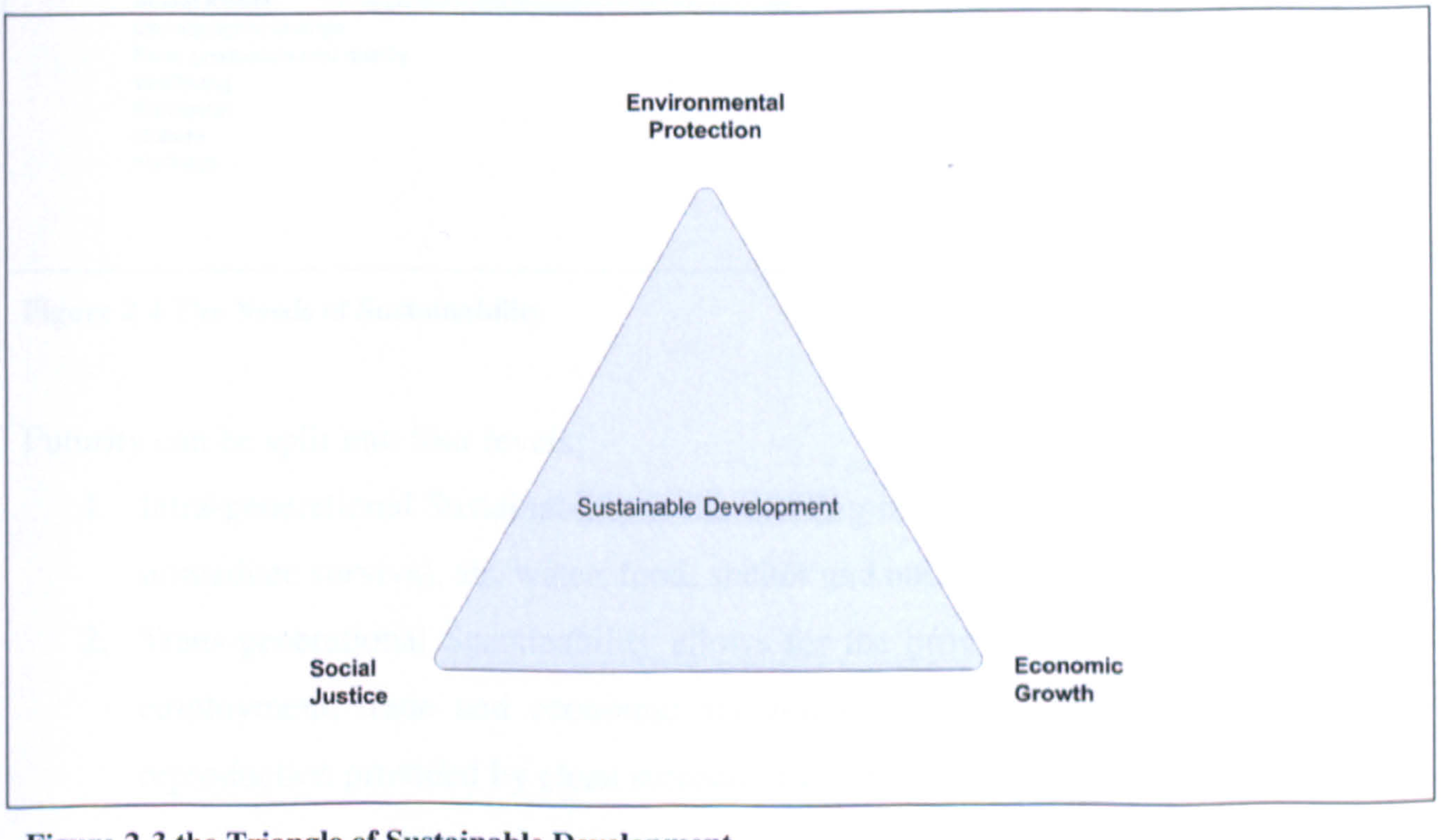


Figure 2-3 the Triangle of Sustainable Development

Whilst this concept develops the need for a balanced approach, it provides a one-dimensional concept that must be further explored. If sustainability at its most simplistic is defined as the meeting of needs, then from a human perspective it is necessary to have a clear grasp of how far in the future that generation is perceived to be.

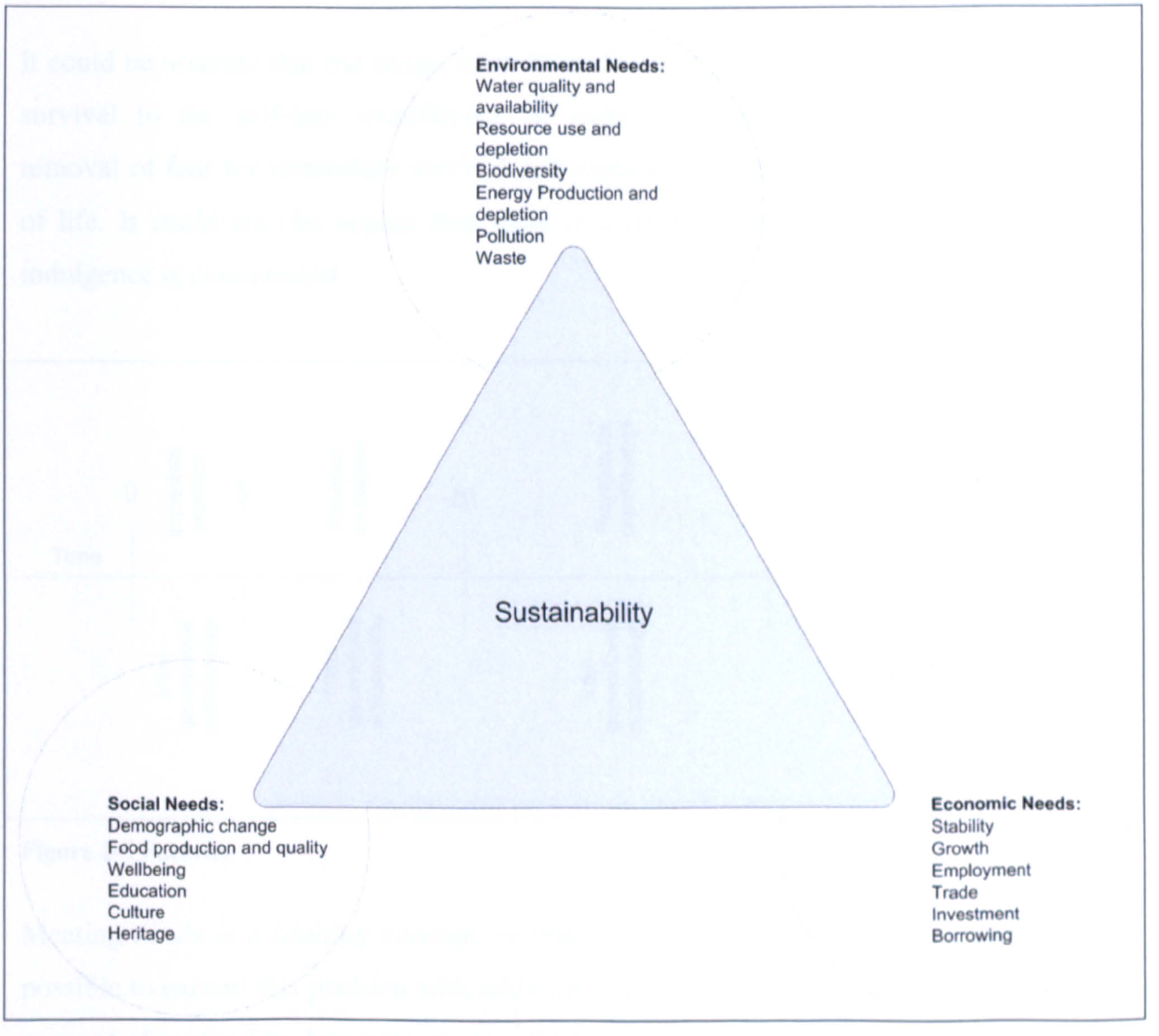


Figure 2-4 The Needs of Sustainability

Futurity can be split into four levels;

1. Intra-generational Sustainability is the meeting of the most basic human needs for immediate survival, air, water, food, shelter and energy.
2. Trans-generational Sustainability allows for the provision of future descendants, employment, trade and economic accumulation as well as health and healthy reproduction provided by clean surroundings and sufficient quantity of food.

3. Inter-generational Sustainability provides for others beyond the family and immediate community. Culture and entertainment, landscape amenity value and food quality, social care and support.
4. Extra-generational Sustainability is provision beyond human survival, concerning the bio-sphere.

It could be asserted that the progression from the most basic human needs for immediate survival to the self-less munificence of extra-generational sustainability required a removal of fear for immediate survival and replicates the evolution of society or quality of life. It could also be argued that there is a point at which needs are fully met and indulgence is commenced.

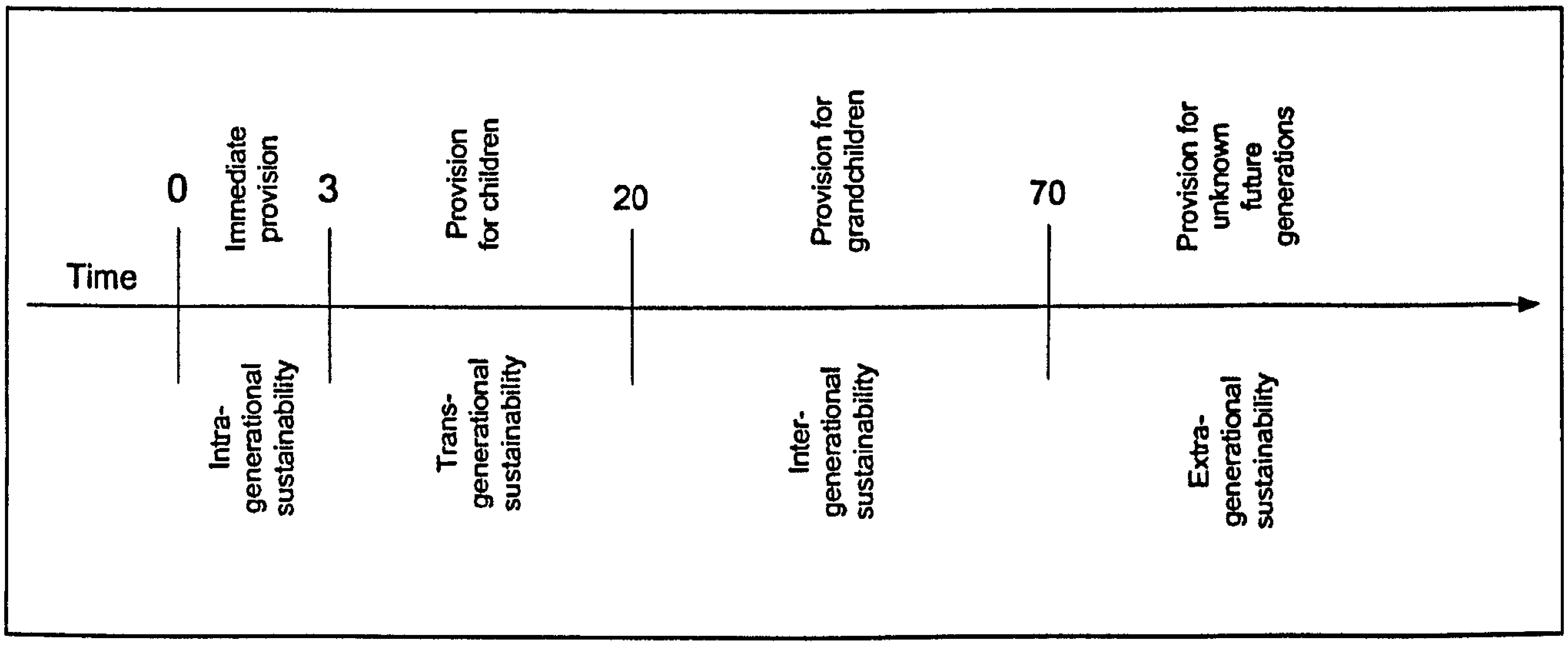


Figure 2-5 Futurity

Meeting needs is a limiting concept, in that it suggests a discharge of obligations. It is possible to exceed this position with additional effort. This application of effort forms the concept of profundity; however greater effort is met with greater resistance but is directly proportional to the positive impact that effort. Figure 2-6 demonstrates this concept.

Whilst these concepts of *philosophy, futurity* and *profundity* could be conceptualised as ascendancy towards a higher plane of consciousness, quasi-religious connotations should be avoided in pursuit of a unilateral understanding. Rather they provide a three dimensional model of *significance* which will form the defining concept of sustainability that will be used for this research.

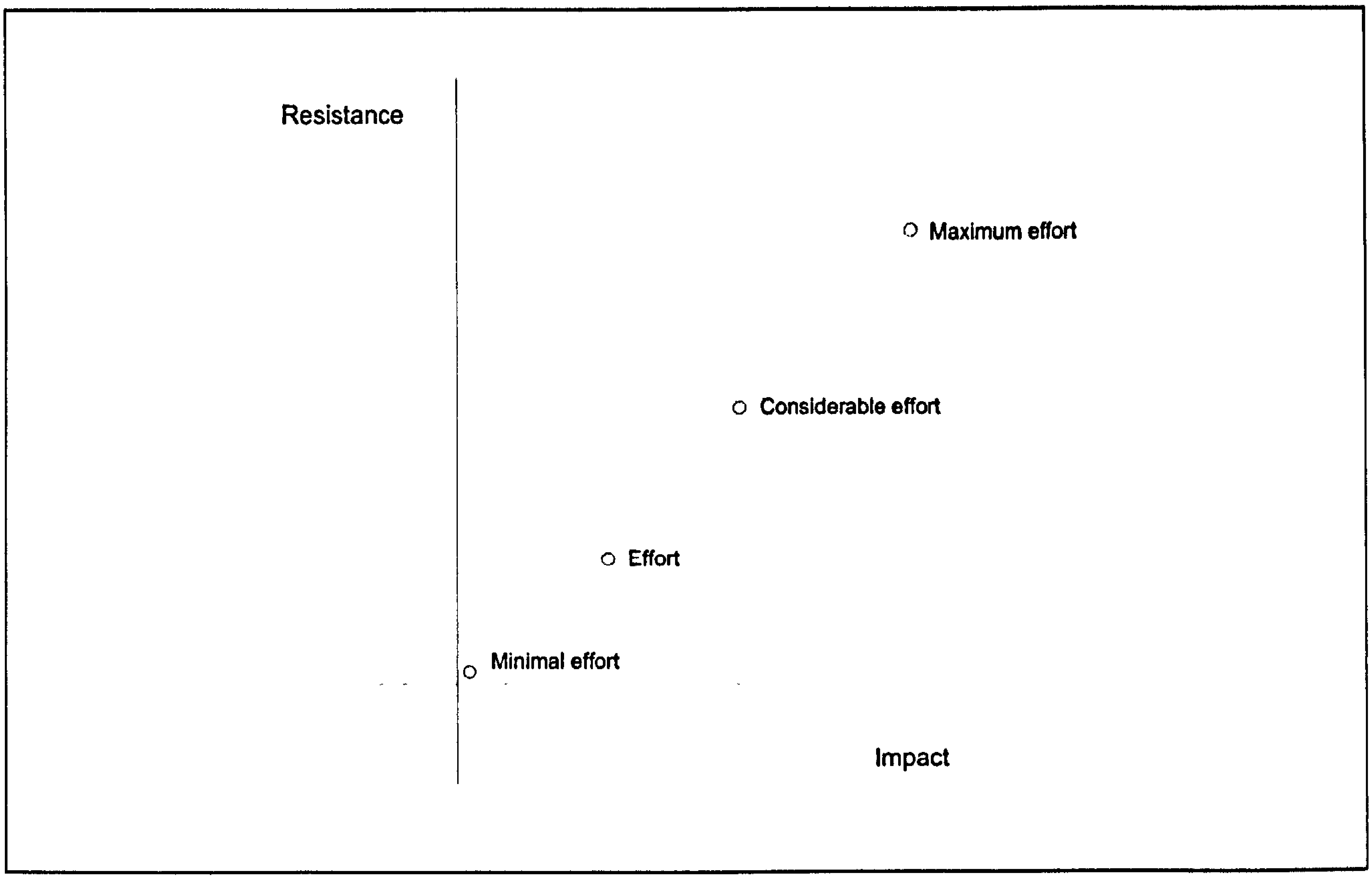


Figure 2-6 Profundity

2.2 Environmental Architecture and Sustainability

Defining architectural styles and theoretical standpoints has long been a pre-occupation of the architectural profession. The practice of establishing a paradigm has been in existence from the start of the neo-classical period. Architectural history and theory has traditionally been taught as a chronology of styles and movements, with special interest in the conflicts between styles, such as the Gothic and Classical in the 19^{th} century, and Modernism and Postmodernism in the 20^{th}. This mindset leads the profession to attempt to apply names to classify a particular design approach. Although Van Der Ryn and Cowan (1996) argue that architects had no environmental vocabulary pre 1970's, there is a body of architectural work that has reflected on man's position within the ecology of the earth prior to the advent of 20^{th} century environmentalism. This section seeks to understand how the concepts of environmentalism and sustainability have been applied in architecture.

2.2.1 Environmentalism and Architecture

There is a consensus (Olgyay 1963; Hawkes 1996; Hagan 2001) that the earliest writings that considered the nature of the environment and how it is made apparent in building were evident in Vitruvius (1960).

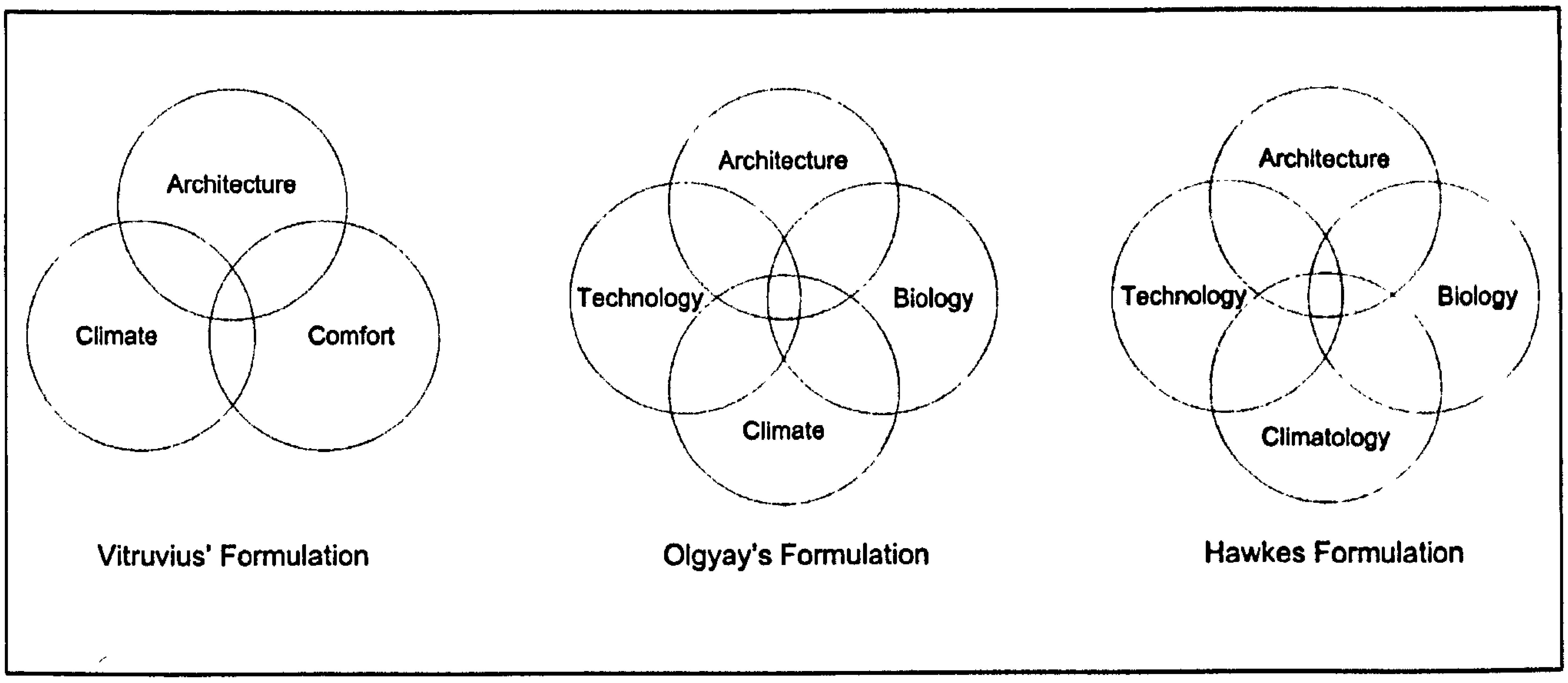


Figure 2-7 Formulations of Environmental Architecture

These three requirements of considered the most fundamental requirements of buildings. This method of resolving the needs of the building user in the form and materials of a building has been fundamental in establishing civilization in climates where the unprotected human could not survive. Vernacular building techniques from all climatic regions have allowed communities to thrive in harsh environments. Commonly they respond to diurnal and seasonal variation well and use locally sourced materials. This makes vernacular buildings inherently environmentally responsive. Cultures tend to rely less on vernacular wisdom as they experience economic development and increasingly consider fashion and taste as the prime motivators of their architecture which parallels the progression of society from ecocentric to technocentric ideologies discussed in the previous section. The result of this aestheticisation of architecture is increased consumption of materials from further a field, and introduction of architectures that are less appropriate for the local climate, necessitating increased servicing loads. In many developed societies, the rediscovery of the methods of vernacular architecture has fuelled both theoretical work and built example (Vale, 1996; Hagen, 2001). In some developing nations however, use of vernacular can be perceived as patronizing sentimentality (Hagan 2001) or crude climatic and cultural determinism. Hagan (2001) suggests that those who use the vernacular as a generator of environmental solutions fall into two groups; (*ecocentric*) anti-industrial pro-craft revivalists and those seeking theoretical models for passive environmental design (*climatic differentiation*). Olgyay (1963) wrote about the interlocking fields of climate balance as early as 1963 (Figure 2-7). Very much like Vitruvius' formulation, his work shows no pretensions to aesthetic style whilst maintaining the need to tie the technology into good design. Givoni (1969) followed Olgyay with a more scientific approach to the same problems of climate and comfort without any suggestion of how good aesthetic architecture might be achieved in technological development

Colonial development establishing Western European architects and building practices in diverse climates may have resulted in forced development of building technology and design initiative to cope especially with heat and humidity in tropical zones such as Lutyens work in India and New World architecture of this period (Banham, 1984). Banham (1984) suggests that the introduction of internal electric lighting was a considerable factor in the advancement of the new styles of architecture commencing with Art Nouveau in the 1890's. Both the work of Morris and Ruskin have many references to the environment and the potential dangers of industrialization. This Romantic Movement in architecture was strongly associated with early environmentalism (Pepper, 1984) and has informed the development of the Arts and Crafts Movement and Organicist architectures (those using natural forms as literal or metaphorical inspiration).

Though not consciously related to the threat of environmental collapse, the relationship between man and the environment in terms of comfort and well-being was well explored, not least by Le Corbusier, who's writings have been used by designers to inform their work (Vale 1991, 1996; Olgyay 1963). Modernism and functionalism have been suggested by Hagen (2001) and Slessor (1997) to have strong links with environmentalism if the "function" of a building is partly the modification of the external climate to provide comfort. Banham however contests that the German functionalist schools such as Bauhaus ignored most thoroughly the "*human concepts of environmental quality*" (1984 p124) evolved before 1914, in addition Banham suggests that the intention of the International style modernists had been to rid the world of the inadequacies of vernacular architecture. Thus, the relationship of environmental architecture and Modernism is somewhat paradoxical in nature. Perhaps the strongest factor of modernism that positions it firmly as the progenitor of technological solutions is the precept that technological progress leads to material growth and the *technocentric* machine aesthetic.

The environmental architecture of the 1970's concentrated on energy prompted by the developments in environmentalism surrounding the oil crises as discussed in the previous section. The amount of energy used in the running of buildings has increased due to the introduction of building services during the course of the last century (Banham, 1984). Solar power and the ideas of passive solar design and passive ventilation grew into the main concepts used to define the environmental architecture of the period. Improving design and position of windows and openings, and the thermal performance of the fabric became the key to energy saving. These principles made a dramatic impact on housing design and led to the introduction of Part L of the UK building regulations for the conservation of fuel and power. The concept of Low Energy Buildings was introduced, although still mainly realised as one-off homes designed for enlightened clients and architects themselves, a few local authorities began to take some interest in reducing running costs of housing through passive solar design. Examples can be seen in Hawkes and Owers (1981) and Vale and Vale (1991).

By that time, environmentalism had taken on its political meaning and environmental design was becoming more self-conscious. In the 1976 preface to the second edition of Givoni (1969), he acknowledges the new relationship of man in the environment that had become current since the first publication.

Banham (1984) categorizes building types in to four modes of environmental control; Conservative, Selective, Regenerative and Exclusive. The Conservative Mode aims to temper changes in external climate by thermal storage, primarily by massive walls. Banham saw this as the "*the ingrained norm of European culture.*" (p.23), typified by heavy masonry structures. The Selective Mode expels unwanted conditions and admits the desirable and has always been mixed with the conservative mode in elements such as windows, shades and ventilation devices. The Regenerative Mode applies energy in the form of heating or cooling and introduces artificial light. In traditional construction, all three modes are employed but most built forms tend towards one or other mode. Banham also claims that the Conservative/Selective mode...

"...sees power consumption as an embarrassing aberration. Their embarrassment was fortified in the Sixties and Seventies by the growing tide of concern about pollution, energy costs and the depletion of finite natural fuel resources." (p.277)

The response in Banham's opinion was the "passive" Solar Movement in architecture. This movement was primarily concerned with low technology and rarely explored "active" solar power. Banham saw the majority of this movement as fanatical and to a certain extent exploitative of the domestic (female) effort required to alter blinds, open vents etc. Banham's fourth Exclusive mode has no relation with the environment and is typified by highly serviced buildings. These are designed in a manner that makes an internal environment sealed completely from the external.

Hawkes (1996) demonstrates a climate balance diagram of biology, climatology, architecture and technology (Figure 2-7) very much in the manner of Olgyay. However, his definitions of building types follow in the pattern of Banham; *Pragmatic*, *Exclusive* and *Selective*. Where *Pragmatic* ignores environmentalist themes, *Exclusive* reflects a more considered level of design than Banham's mode but still works exclusively form the external environments. The *Selective* mode filters the external environment in a combination of Banham's Conservative, Selective and Regenerative modes. Mapping environmentalist architecture in the same way as environmentalism shows the development of the aesthetic and ideological themes are closely parallel.

A number of commentators have chosen to dissect environmental architecture into a direct parallel with O'Riordan's *Ecocentric* and *Technocentric* ideologies; Guy and Shove (2000) define these ideologies respectively as those that feel social responsibility and those that wish save on energy and material costs for their own benefit. Similarly, Lloyd Jones (1998) claims that there are two profoundly opposed schools of architectural thought, Cultural-fix and Techno-fix. This dichotomy represents those (ecologists) who believe that a change in the culture and attitudes of society (even if they have to be enforced by regulations or levies) is required, and those (technologists) who see technology providing the answers to the problems we have forced upon the environment thus allowing society to continue to function as it has evolved over the centuries of industrialisation. These two schools have profoundly different design methodologies, which are aligned with modernist/functionalist aesthetics (technocentric) and post-modern/organiscist (ecocentric).

Ecologists, Van der Ryn and Cowan (1996) suggest that the esoteric aspects of design are critical. These are listed as nature, place, biodiversity, vernacularism and manifestation of didactic teaching through design. The ecological approach has further developed into a more defined ecology theory by the use of observations of ecosystem as models or metaphors to help in the design of construction and industrial projects (Kibert et al 2002). This group argues that we have become ecologically illiterate through our separation from the natural environment by the built environment and that we need to rediscover our relationship with nature through this representation. This principle is *Ecomorphism*, where a building is representative of a system as apposed to *Biomorphism* where a building represents the form of an organism and not necessarily considered environmental architecture in the same way that Organic forms represent nature, without necessarily being natural. They would also argue that this is not an ideology but a scientific methodology although not one that follows the rules of empiricism (Van der Ryn and Pena in Kibert et al, 2002).

Technologists, Thomas and Fordham (1996) offer five elemental considerations required to form buildings with an energy balance through the measurables of skin materials and U values, site planning, energy use, comfort and daylight. solar, ventilation, material solidity, air quality and moisture. Slessor (1997) suggests an association with High-Tech, recommending works by Foster, Rogers, Grimshaw and Hopkins as examples representing application of the technological approach.

Hagan (2001) concludes that there are three categories of environmental architecture; *Symbiosis*, *Differentiation* and *Visibility*. Symbiotic design uses statistical factors to constrain its brief; hence it falls very much at the technological end of the spectrum. Hagan suggests that one reason why Symbiotic architecture is closely related to the modernist and high tech stream is the ease of calculation of environmental effects in and around orthogonal and regularized forms reflecting the International Style thus representing the technocentric school. Hagan divides differentiation into two distinct methodologies; cultural and climatic differentiation. Cultural Differentiation responds to

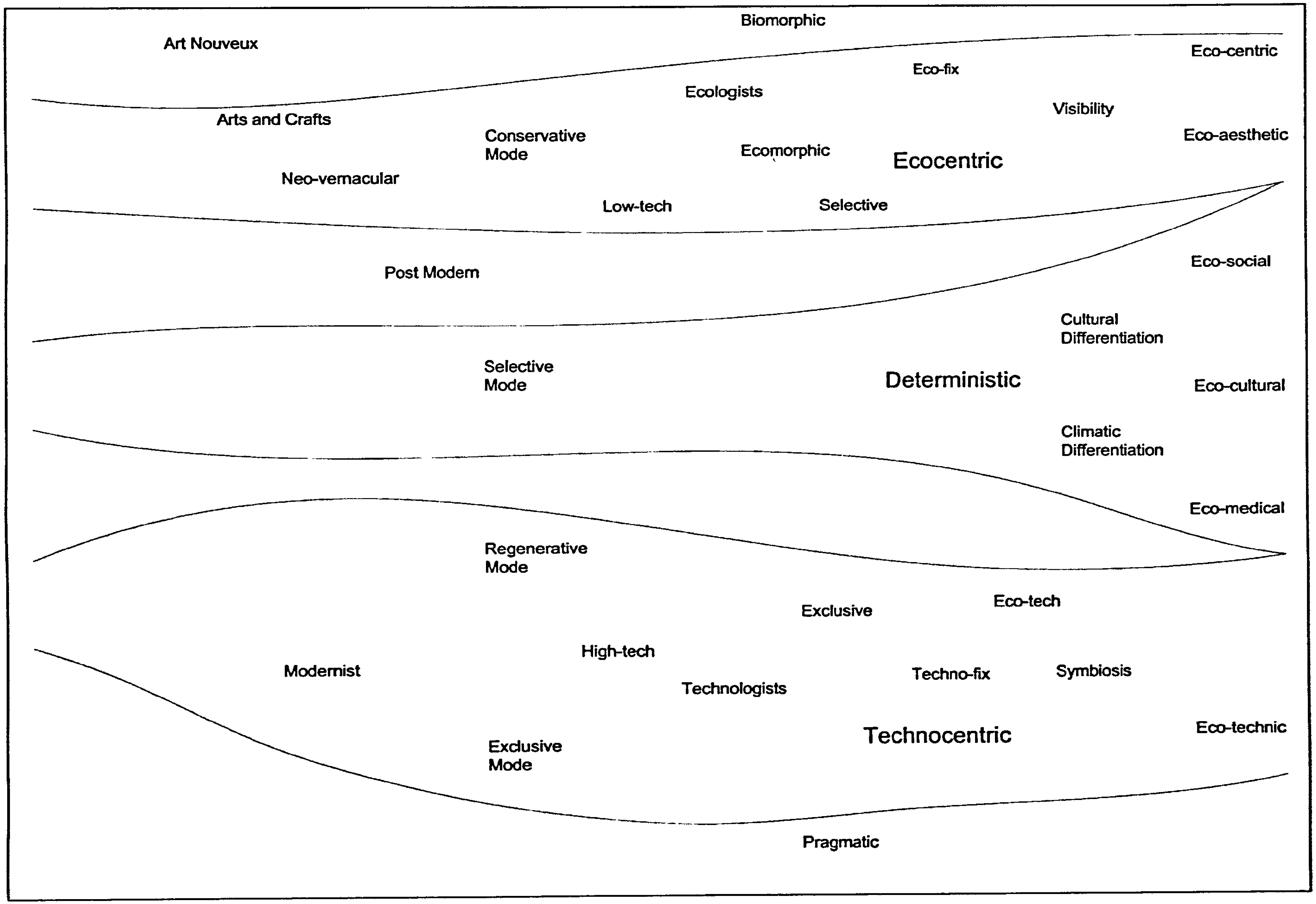


Figure 2-8 Mapping 20th century Environmentalist Architecture

the vernacular and social aspects of the genius loci. Through an understanding of the lifestyle of an indigenous people, it is believed that a design solution will by nature respond to the environment. Climatic Differentiation however uses geographical and meteorological data to formulate a scheme. Both of these respond to Vitruvian ideology via the complementary design principles of Olgyay and Hawkes, and as such reflect Darwinian determinism. Hagan's architecture of Visibility is defined by the intent to make environmental ideas clearly legible in the aesthetic treatment of a building. It allows the conception of architecture as art to remain in place. Hagan is willing to accept that all three categories are distinguishable in the work of many architects, however one will be dominant. It is also suggested that they are a layered profundity of thought in the environmental design process. As an example of one way of designing, Symbiosis is the initial requirement to achieve fixed requirements or targets, the designer may then go on to respond to the local environment of the building and finally attempt to make their design efforts visible to the user.

Guy and Shove (2000) argue that those that wish save on energy and material costs for their own benefit and those that feel social responsibility in acting against global climate change and resource depletion are essentially opposing human behaviour patterns, not technological problems, and are a barrier to implementation of researched work into action. Guy and Farmer (2001) split environmental architecture into six categories using built examples and architects for definition. This metalogic spans the ecologist to technologist spectrum; Eco-technic, Eco-centric, Eco-aesthetic, Eco-cultural, Eco-medical and Eco-social. Eco-technic represents a broad grouping of methodologies from Hawkes' Pragmatic to Selective modes. Eco-centric is the antonym of Eco-technic. The other four are between these extremes, with Eco-aesthetic corresponding with Hagan's Visibility; Eco-social and Eco-cultural straddle Cultural differentiation and flow from Vernacularism and bio-regionalist traditions. Eco-medical is a direct descendant of Givoni (1969) and Hawkes (1981) on positive human environments but has now encompassed sick building syndrome, employee efficiency and other more recently researched phenomena that regard human health and well-being in internal environments.

2.2.2 Conflict in Definition

Using the work of particular architects to illustrate the aesthetic and conceptual ideas of environmentalism in architecture is not entirely straightforward; for example Le Corbusier's machine ethic contrasting with his work in India. Others, such as Erskine have evolved over long careers and have shifted slightly from one stream to another. The use of the work of certain architects to define methodologies can be misleading. One such example is Ken Yeang. Yeang has his own philosophy, which he calls Bio-climatic architecture. It is derived from the deterministic geographical and climatological principles of Olgyay whilst allowing expression through new materials and building forms such as the skyscraper. The main characteristics of Yeang's architecture are to replace the natural species that are lost by development particularly in the tropical climate of South East Asia where many of his built works are located and this is aided by the redirection of rainwater. This vegetation offers a trade off against the carbon produced by the servicing of the building and a buffer against the harsh environment along with space planning to avoid adverse solar gain. He confesses that he pays little service to the constraints of energy, life cycle analysis or sustainable development (Richards, 2001). Jencks sees Yeang as Organitech (Rattenbury, 2002). Guy and Farmer (2001) give Yeang's work as an example to typify their Eco-technic Logic. Hagan (2001) describes Yeang's work as Climatic Differentiation, whilst Lloyd Jones defines Techno-fix. Yeang's earliest writings introduce Bio-climatics very much in the style of Givoni, Olgyay and Banham, forcing Yeang's work into a more central determinist position. Close scrutiny of his architecture would suggest that there is much less attention to technical measurement of building performance and in contrast a keen interest in more the softer aspects of low-tech and passive environmental tempering. This suggests that the outward symbolism of environmentalism (Hagan's Visibility) may in some circumstances override both Differentiation and Symbiosis thus inverting Hagan's theory of progression of environmental design sophistication.

This conflict could be explained in two ways; either that the labels being applied are subjective and the architects work is misunderstood, which would be true if the aesthetics of Yeang's work were being described. Alternatively an architect's body of work and individual buildings may respond to a variety of needs that might affect the ideology that is most suited to the circumstances. Therefore good architecture can and should respond to the needs of sustainability in technocentric, deterministic and ecocentric ways as appropriate, and that this might represent a balanced philosophical approach.

2.2.3 Sustainability in Architecture

It is apparent that the definitions used by writers and designers have been interpreted by each to explain their own ideas relating to their work or their reaction to the work of others in the context of the environment as we are presented with the environmental problems of the time in which the definition is used. The wealth of environmental architectural history cannot be denied, however, we must remember that this represents a very small fraction of the construction industry as a whole. The parallels that can be drawn between environmentalism and environmental architecture, the architectural world has responded to the changing pressures of the three themes of environmental instability. Unlike environmentalism however, architecture bridges the divide between art and science supported by many paradigms, this sets up a tension between satisfying both objective needs and subjective wants. Whilst it can be argued that environmental architecture is not an aesthetic style, it is without doubt a movement albeit separated into three overlapping strands of Ecocentrism, Determinism (Differentiation) and Technocentrism. These qualitative definitions will be used to define design philosophy.
As a concept, sustainability cannot be aligned to any particular aesthetic; instead it is a state of consciousness of the place of the design in the wider context and future environment.

2.3 The Evaluation of Sustainability in Architecture

As we have seen environmentalism in its many forms provide a wealth of inspiration in the theoretical and aesthetic treatment of the built form. However in order to truly demonstrate a balance between the needs of environment, society and economy, it is necessary to be able to measure in some way, the contribution that any building makes to sustainability. Whilst aesthetic or theoretical philosophy is a justifiable means with the architectural fraternity, building procurers and other stakeholders increasingly demand proof of claims made. This section discusses why it is necessary to formulate quantifiable criteria.

2.3.1 External Forces

External forces can provide a strong guiding force for change in the building industry. Complying with regulations such as Part L (2006) of the UK Building Regulations may prove significant. A great deal of environmental architecture of the 1990's based its claims on the merits of exceeding regulations, this baseline has been raised and will be successively raised in the future. While building control officers become more familiar with the new method of assessment, it may be possible to chart a change in the industry's practice of just complying with a tendency for over specification to ensure compliance without unexpected cost increases at tender stage.

Increasingly, planning authorities in the UK require Sustainability Statements as part of the planning submission for major new developments. These are rarely detailed or comprehensively compiled however, and can suggest a far greater effort and concern for the environment that is the reality. There has also been a move towards the introduction of environmental benefits as part of Section 106 agreements. It is easy to imagine that this method of a local council insuring their environment against excessive damage whilst accepting the social and economic benefits a development might bring. From the point of view of the architect, it is a convincing way to increase building procurers' awareness of green issues as a major part of commercial decision-making.

External requirements such as building regulations and planning guidance from central government would seem to be the most effective way to collate information and set benchmarks for construction. Change in externalities help to force procurers to accept increasing costs and considerations in order to comply with legislation and designers must always be one step ahead to remain competitive. However, these forces are problematic in the long term as they are not constant enough to provide a basis for economic calculation as sudden changes in policy can make considerable difference to the economic value of certain aspects of a buildings' design that are also environmentally beneficial.

2.3.2 Research and Development

Research and development within the construction industry is problematic. Academic research is slow to be implemented by the construction industry; one reason for this is lack of reference to professional practice. Ashworth (1994) points out that that this is the case for research in the area of construction cost. Raftery (1991) agrees on this point; that scholasticism in the construction industry must be based in real world problems. Design consultants may be more likely to partake in research because they can perceive a need for change to current practice. Ashworth (1994) suggests that the costing profession has been prepared to assume that the way cost studies have been carried out is correct without questioning the fundamental principles. The case study and demonstration project is the most popular method, but this is often dependent on some outside funding to be viable. Procurers are not willing to expose themselves to the risk of experimental design, and few consultants are willing to risk indemnity for failure of a design if it is not based on well tested principles. Despite these risks all live projects can be viewed as a form of research despite not being generally viewed as such by academia or industry (David Bartholomew Associates, 2002). The role of the architecture and construction media in extending awareness of environmental issues within the industry must be considerable, although to what extent these messages reach procurers is unclear.

Guy and Shove (2000) have studied how environmental research in architecture is funded, it would seem that more sponsorship is available at times of high fuel prices. Most research published has been based on energy use and related cost benefit analysis. Periods of economic recession also provide opportunities for research funding to support practices with a falling workload to be a future market for low energy and environmentally conscious design. Research and development in the area of environmental design becomes possible as workload slows allowing speculative work and competitions to be undertaken in a bid to gain more work. Procurers were less likely to rush into projects and office development that went on was predominantly for procurers who intended to use the building themselves and hence were more interested in long term running costs than the speculative developers of the 1980's had been. This resulted in a dramatic increase in "green" offices completed in the 1990's. It can be seen that research is invaluable to industry but its results are hidden by lack of documentation of design development research work and masking by certain sections of the industry to protect commercial interests.

Whilst external forces are critical to the encouragement of environmental projects, they are difficult to define in the long term as they change too rapidly. Research plays an important part in driving change in externalities, however, political and economic factors are also a major influence on research, and whilst research can take some time to proceed from inception to publication, political and economic factors can have dramatic impact in short periods of time. Therefore these external incentives and barriers are important but volatile entities that can have a major effect on the project both in the design brief and also in the ongoing and evolving effect over the building lifetime.

2.3.3 Gauging Success or Failure

It is useful to the building procurer be able to assess if a project has succeeded in its goals. Cost and programme are comparatively straightforward criteria in comparison to sustainability. It would seem vital that in order to achieve their aims, architects need to have real and compelling proof that their designs do provide the environmental solutions they promise. Design performance criteria are usually established by parameters for use and space allocation, and technical requirements and specifications are determined a part of the brief.

There is no conclusive correct method for the design of environmental architecture, but it would seem that the widest benefit would result from the implementation of the broad spectrum of ideas. The methodology of design is intensively subjective and dependant on the accurate capture of both procurer and externality specific values and constraints. Balance between the needs of sustainability in this methodology can only be achieved with management of objective criteria (or sustainable development). Whilst ethical arguments may work in academic and to a lesser extent political spheres, persuasion of the majority of construction customers is primarily economically driven, social and environmental considerations follow. In order to increase the proportion of environmentally considered built work in the construction industry, reliable complementary methods of subjective and objective analysis must be both formulated and supported by legislation.

The finite measure is a limitation, allowing stagnation unless the categorisation is reviewed over time. Infinite measurement allows no perfect solution, only proof that a project is better than what has been measured previously. From the point of view of long term environmental sustainability, it could be asserted that infinite measure is the ideal.

Secondly comparative measurement of one project against another requires an accumulation of data. True accumulation is only possible where one methodology prevails.

2.4 Criteria for sustainability in architecture

As has been discussed in the earlier sections of this chapter, sustainability requires social, economic and environmental needs to be met with a balanced philosophy, far reaching view to the future and a profound level of effort. These have no specific order but provide a three dimensional measure of significance. The objective of this section is to outline what this means for architecture.

2.4.1 Philosophy

The environmentalist literature defines three philosophical standpoints of Ecocentrism, from the Romantic tradition, Technocentrism from the Newtonian tradition and Determinism from the Darwinist tradition. Whilst these philosophies may have positive and negative aspects, each can be seen to serve one aspect of sustainability. Ecocentrism

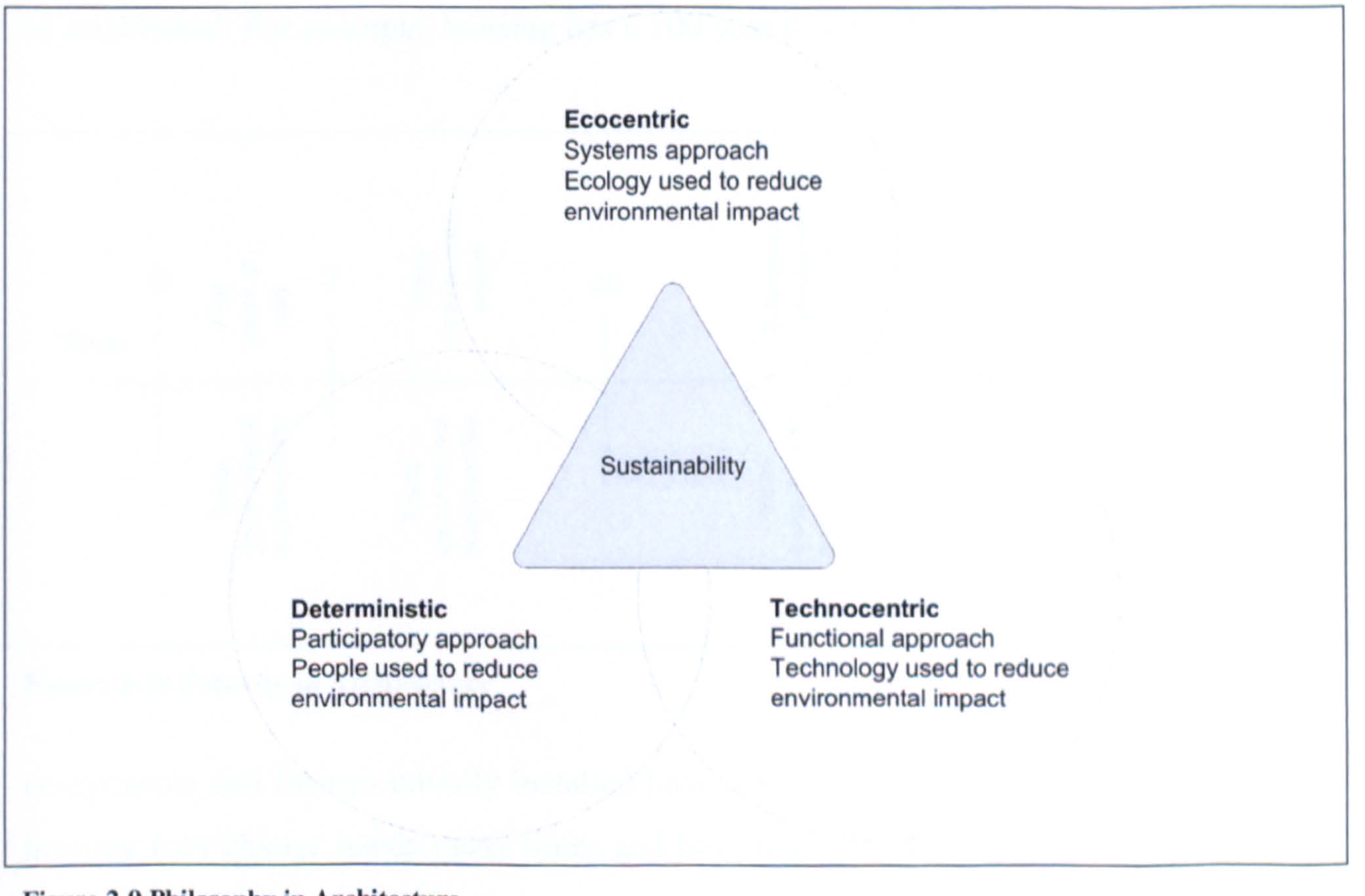


Figure 2-9 Philosophy in Architecture

serves environment needs, Determinsim serves social needs and Technocentrism serves economic needs. As such they form the balance of sustainability, but unlike the triangle of sustainable development where the needs would appear to conflict, they allow an intersection of balance at the centre of which, negative environmental, social and economic impacts are minimised. In built form this absolute balance may be difficult to achieve but is the ideal that should be aspired to. This is an expression of how the needs are met or impact minimised by the built form rather than the needs themselves, the response of a built form to the challenge of balancing the conflicting environmental social and economic needs.

2.4.2 Futurity

As a concept, futurity in its most simplistic terms represent a four stage hierarchy of consciousness of future needs; following the intra-generational, trans-generational, inter-generational and extra-generational view. These divisions must be calibrated by the built form rather than the human conditions described in the first section and are subject to the aspirations of the building procurer and the design life of the building. It is difficult for the procurer to guess what might happen to a building in the future beyond their known commitment, and whilst they can plan for a variety of eventualities, the limits to that must be established. For example, housing has a 100 year design life, but many of the

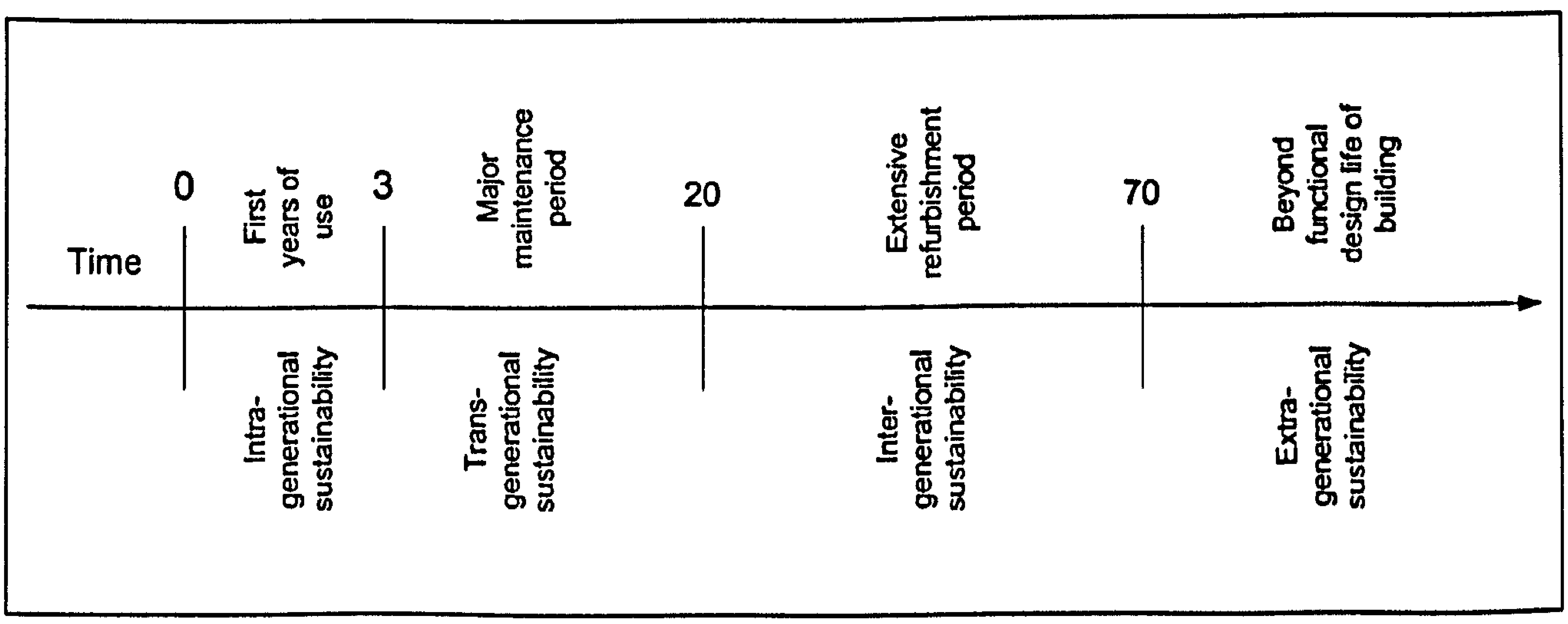


Figure 2-10 Futurity in Architecture

components and fittings initially installed have a shorter expectancy or warranty and the housing may change hands many times and have multiple modifications in that time. An industrial building might be structured around a ten year business plan and the known need for a product, which may become obsolete before the external structure does.

Similarly the need for rented office space may fluctuate with the economic climate and the building may take on another use after a period. It is important that this is not used as an excuse for ignoring long term impact of a building and is therefore expressing future impact of the built form upon the environment, economy and society in response to future needs.

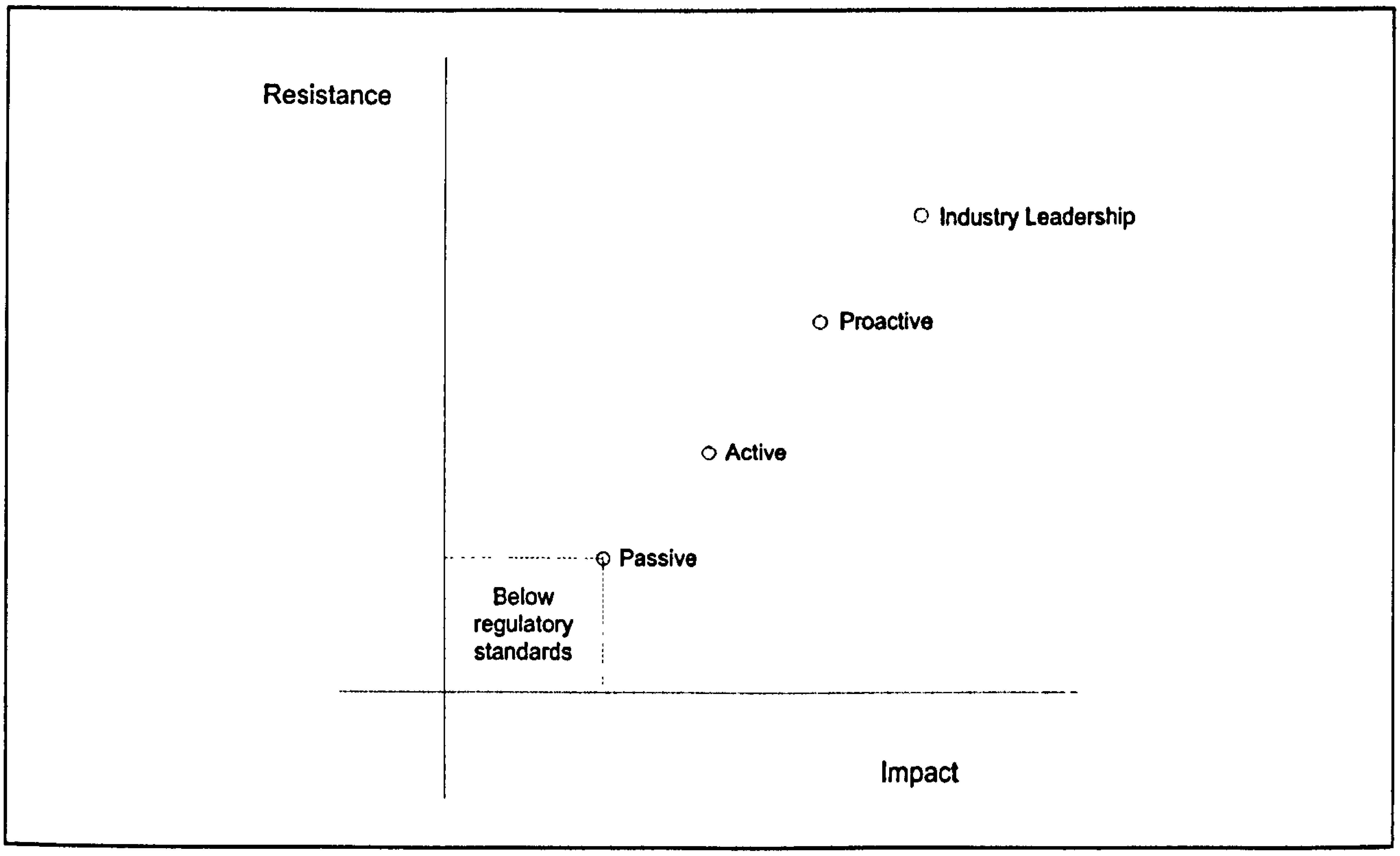


Figure 2-11 Profundity in Architecture

2.4.3 Profundity

Profundity represents a measure of effort against resistance that is anticipated to move beyond that which is baseline. In architecture, the regulations surrounding construction provide that baseline, and effort beyond that can range in profundity. The resistance is provided by internal and external factors, such as cost, procurer and consultant inertia, technological limits, legal and insurance complications, stakeholder opinions and approvals. In order to provide some calibration, the following categories suggest three levels of profundity beyond the baseline;

1. Passive; meeting legislative requirements
2. Active; exceeding legislative requirements or good practice standards

3. Proactive; exceeding legislative requirements through research analysis and development or exemplary practice
4. Industry Leadership; highest possible standards best practice or best practice

2.5 Conclusion

The aim of this chapter was to establish criteria for the evaluation of sustainability in architecture. This has been carried out by defining a concept of sustainability and how it is interpreted in architecture. The first section of this chapter has demonstrated through the historical development of environmentalist philosophies that sustainability is provided by the consideration of social environmental and economic needs. The second section has demonstrated that architecture has closely followed these philosophies. As we have seen, these concepts provide a wealth of inspiration in the theoretical and aesthetic treatment of the built form.

This chapter has demonstrated through the review of environmental literature and architectural traditions that the definition of *environmental architecture* is redundant. This aesthetic and ideology based approach is no longer relevant in the 21st Century to define sustainability as all buildings must define their impact and measure the significance of the contribution made to sustainability. The 21st Century definition of sustainable architecture is similarly complex; firstly a building can be sustainable without being classed as architecture because all development must have some consideration towards environmental protection, social justice and economic growth.

The proposed criteria will be used to demonstrate the significance of consideration as a response to the needs of sustainability;
Philosophy – the balance between ecocentric, deterministic and technocentric ideologies being used to reduce the impact of a built form.
Futurity – the limits of substantiation of the impact of a built form in the future.
Profundity – the level of effort made to reduce impact above the baseline condition.

This framework could be used in this simplistic form to analyse the significance of a particular project or comparing projects in reducing impacts. Whist it has been used here to broadly with a view to defining architecture of all forms within the range of the minimum and maximum conditions, the application going forward will be specifically within the scope of retail architecture It can only be used in a subjective manner, and without some kind of design methodology to apply it and as such will not satisfy the needs of this research without further development. The framework is limited by the assumption that the environmental issues and problems understood by society to be relevant to sustainability (such as global warming, waste and pollution, availability of resources etc) and the social and economic factors with which they are linked are fully understood and equitably managed through potential conflict and compromise. Managing these issues is a responsibility which is placed upon those that are in a position to make decisions that will affect the environment, society or economy and will be dealt with in the development of this framework into a design methodology framework in later chapters. It is first necessary to understand the context in which it will be developed. The next chapter considers the retail industry and how the criteria defined in this chapter could be used for application specifically in retail architecture.

3 The Retail Industry

The aim of this chapter is to establish the nature and context of the retail industry and how criteria for sustainability established in chapter 2 can be addressed in retail architecture.

This aim will be pursued through the following objectives;

1. To outline the historical and geographical context of the UK retail industry.
2. To review theories and concepts used in retailing and how these are addressed in retail design.
3. To identify the specific challenges to sustainability in retail architecture in design, procurement, maintenance and facility management.
4. To apply the criteria for sustainability established in chapter 2 to retail architecture and illustrate how this will inform the development of the design methodology framework.

The first three objectives will be carried out using literature review together with anecdotal evidence based architectural practice in retail architecture. The fourth objective will utilise logical argumentation and apply it to the findings of the first three objectives.

3.1 The Retail Industry in the UK

Over a third of consumer spending in the UK goes through shops. UK retail sales were approximately £246.9 billion in 2004 11% of all enterprises in the UK are retailers. The retail industry employed 2.9 million people, as at the end of June 2005. This equates to 1 in 9 (11%) of the total UK workforce, which has grown by a quarter of a million over the last five years. The significance of this industry to the UK economy cannot be overestimated.

Retail forms in the UK have for the most part grown out of economic forces from the earliest market places in medieval towns within walking distance of surrounding communities. Up until the 19^{th} century, development of individual shops was incremental and led by the business investor. Since that time new forms have continued to develop led by private investors, corporations and municipal interventions, these can be outlined as the following; Town centres and high streets, department stores, covered arcades and precincts, shopping centres, out of town development, outlet villages, supermarkets, co-operatives and markets and on-line shopping.

3.1.1 The Town centre and High Street

High street retailing involves three types of retailer; multiples (or chains), independents and co-operatives. Multiples, defined as having ten or more stores have taken over the high street in major towns since the middle of the 19th Century (O'Brien and Harris 1991), however, small market towns and large villages often retain many independent retailers despite a large reduction in numbers of independents since the Second World War. According to O'Brien and Harris (1991), retailing in Britain was characterised by price competition in the 1970's when sales growth was slow. In the 1980's image became more important, and with that an increased awareness of marketing strategy. At the same time, the number of shops decreased, particularly the independents as chains grew and were amalgamated and increased their product range and competitive pricing strategies, putting small traders out of business. These theories are less representative of 21st century retail forms as retailing changes to meet new markets. Town centre re-development have replace brown field sites with new streets which soon become integrated into the urban fabric often improving footfalls at the peripheries. Figure 3-1 shows an example of modern infill within a historic town centre.

Considerable efforts have been made by planners to prevent new development that would have a negative impact on town centres, requiring retail impact studies to be submitted with planning applications. Research in Australia (Landini in Tucker 2006) has shown that major shopping destinations initially pull chain retailers from smaller town centres forcing a rent dive and empty shops, this is replaced by many small independent retailer cashing in on socially responsible market for organic, delicatessen and unusual products for the local market. The success of these stores however is dependent on the affluence of the area and the market for specialist goods of that nature. Many of these small retailers would supplement local sales with a web-based enterprise. The difficulty with this specialty market principle is that the empty period is very distressing for the small town and may need extra support from local authorities and organizations such as Chamber of Trade to induce the renaissance.

Figure 3-1 Modern interventions in Ely town centre (Source: Simons Design Ltd)

3.1.2 The Department Store

Department Stores are a 19^{th} century phenomenon which have persisted in popularity although their methods and hence their designs have changed since their earliest days. These were originally independents that have since expanded from the drapery trade into selling a vast array of goods. Then, large windows were required to display almost every article for sale to allow window-shopping by their customers. The domain of 19^{th} Century middle class ladies (Nixon in Shields, 1992) they provided a form of entertainment and for a group made increasingly wealthy by the industrial revolution and the expansion of the British Empire. In the 20th Century, this retail form evolved to provide a better range and quality of goods and a higher class environment and image that took many years to establish. Today five big department store chains, Debenhams, Fenwicks, John Lewis, House of Fraser (amalgamating Rackhams, Binns and Kendalls) and most recently Selfridges, have expanded throughout the UK whilst Harrods is a single store in London, attracting as much custom through tourism as general sales. Other large independent department stores exist throughout the UK.

Figure 3-2 Selfridges Bull Ring, Birmingham overlooking Moor Street Station (Source: Simons Design Ltd)

In 2004 a major new department store for Selfridges was completed along side the Bullring development in Birmingham (Figure 3-2). Designed by eminent architects Future Systems and with extravagant interior fit outs by a number of designers led by Vittorio Radice, who had transformed Habitat on the late 1990's, the store was innovative and challenging to it's competitors. Despite this challenge, the design of House of Fraser and Debenhams has not been significantly modified and it would appear to be a pinnacle or retail excess that will neither be followed nor bettered for the time being.

In 2005, Barkers, Kensington, part of the House of Fraser group closed their 135 year old store to be replaced with organic supermarket chain, Whole Foods Markets (Butler, S 2005). House of Fraser are also planning to cease trading at their Regent Street Dickins and Jones Store, but have opened new stores elsewhere.

3.1.3 The Covered Arcade and Precinct

The retail form of covering a street to form a weathered arcade developed in the 19th Century. Important examples exist in Milan and Paris, however, Leeds, Newcastle, and London also have notable arcades. The 1950's saw urban redevelopment in the wake of bombing in the Second World War in cities such as Coventry and Bristol. New town designers set about designing retail centres from scratch, and used models from the US. Both of these resulted in open-air pedestrian precincts often supported by local government and including civic facilities such as libraries. Later town centre improvements have taken on the form of covered arcades from the mid 1960's to early 1970's, providing links between two shopping areas or between an area of parking or transport interchange and a main shopping area, often using redundant land trapped from main pedestrian routes. After that time, the concept began to change from a utilitarian, to a more managed and enhanced environment and a move away from Modernist and Brutalist architectures to post-modern and input of private funded development. An early example of this is Eldon Square in Newcastle and the Victoria Centre in Nottingham, both built in the 1970's. More recently, in response to re-urbanisation of retail forms Touchwood Court in Solihul has provided both a large car parking area in the centre of the city and major new retail chains close to the main commercial and civic centres of the town. More recently Australian developer Westfield is developing a new 120,000sqft covered retail site in Whitecity West London.

3.1.4 The Shopping Centre

Seemingly, the next step from creating an internal street is to create an entire internal town (BDP/OIR1992). Originating from the US as Malls, this form was pioneered in the UK by the MetroCentre in Gateshead completed in 1986 in a power station spoil heap. The MetroCentre provides a destination for tourism and entertainment, with fairground rides, bowling and cinema as well as extensive food outlets and comprehensive public transport interchange as well as 330 shops (Capital, 2006). The Meadowhall shopping centre in Sheffield followed a similar pattern, opened in 1990 with 1.4 million sqft of retail space with 195 shops and 11 anchor tenants a cinema, and seating for 3300 people at 28 restaurants, it generates up to 800,000 visitors a week at peak periods (British Land, 2006).

Shopping centres capitalize on the idea of a simulated urbanity of apparent public space (Shields, 1992), introducing performers and events to simulate community events.

> *"In the contemporary world, the signifying and celebrating edifice of consumer culture has become the shopping mall which exists in pseudo-democratic twilight zone between reality and a commercially produced fantasy world of commodified goods, images and leisure activities that gratify transformed desire and provide packaged self-images to a distinctive form of subjectivity."* (Langman in Shields, 1992 p40)

This form has been limited by planning authorities as the carrying capacity is thought to have been reached. Bluewater developed by Lend Lease in a disused quarry in Kent being the last major development opened in 1999.

3.1.5 The Out-of-town development

Increased mobility and car ownership in the UK led developers to exploit a retail form that originated in The US. Retail terraces provided an opportunity for comparison goods such as large household items and DIY stores to congregate in an out of town location. Figure 3-3shows a typical example of this form. O'Brien and Harris (1991) suggest that the Conservative government of the early 1980's allowed this decentralisation to take place, encouraged by their "market" philosophy and studies showing planners fears of impact on city centre shops being unfounded. This form was at it's height by the mid-1980's with a particular boom in 1986 noted by BDP/OIR(1992) which also identified four generations of this form of retail development;

1. Arterial development along arterial roads typically DIY warehouses, car show rooms and furniture sales,
2. Purpose built terrace buildings in prominent road junction sites,
3. Unplanned clustering near supermarkets,
4. Planned higher quality clustering at major road intersections.

Figure 3-3 Out of Town development, Bury Rd Ipswich (Source: Simons Design Ltd)

The economic crash of 1989 slowed down construction of this speculative form and development thereafter was mainly incremental and renewal of existing developments. Many of the early parks and terraces are now undergoing refurbishment and re-branding or even demolition. The fabric of the buildings was often intended for a 20 year life and major re-cladding and roofing works are now required. The retail mix has often changed however, particularly where these terraces and parks developed near areas of employment such as industrial estates and speculative office complexes on edges of towns. Now clothing outlets, and soft furnishing stores are more likely to chose these sites for the benefit of lunchtime shoppers seeking entertainment with free parking.

This form has recently seen a very short turnover in the ill-fated Marks and Spencer Homestore in Gateshead. Completed to coincide with a major redevelopment at the Metro Centre, the store designed by John Pawson and led by Vittorio Radice gain a lot of media coverage on opening for it's cool minimalism characteristic of Pawson's work (Bayley 2005). It would seem that the market was not ready for lifestyle retailing in the price range M&S were offering and also having been unfortunately sited opposite the gates of IKEA, the store closed within a year.

3.1.6 The Outlet village

Outlet retailing developed in the 1990's as a an outlet for post sales goods by retailers. This form provides a group of very uniform tenanted units with strictly controlled frontages and shared management and public facilities and parking. Two major chains have covered the UK, McArthur Glen and Freeport, although some independent centres exist at Salford and Biscester. These centres can utilize historic buildings such as Great Western in Swindon or be new build such as Castleford in Yorkshire. These outlets are formed by creating a linear or circular internal or external walkway lined with small rectangular units. Often the centre controls many features such as signage, shop front design and services. The retailers are required to retail stock at an agreed price reduction from normal high street prices, usually 30-70%. Development of this form ceased in 2000 with the Salford Quays designer outlet centre which would suggest apparent market saturation, both from the point of view of retailers' requirements to distribute final stock clearance and customer demand. Whilst some retailers have a dedicated store design for these stores, such as Sports Soccer's Donnay International and Donnay stores, that is finished to the same standard as the major stores. Others, like men's outfitter Gant have only one outlet at a selected Centre with a very minimal design.

3.1.7 The Supermarket

Traditionally there has existed a strong distinction between food retailers and non-food, however changing patterns of retailing by the supermarkets has destroyed this formal division. Marks and Spenser, started out in clothing on a market stall in Newcastle, however, their food hall is now a major part of their industry. At the same time, supermarkets such as Tesco and Asda have extensive ranges of own brand clothing. Very large supermarkets also stock many household items, in the aim to offer a one stop shopping experience. In attempting to replicate and replace the town centre Supermarkets are addressing one of the driving issues of the 21st Century shopper, that of consumers' time available to shop with high levels of women in work and 24 hour culture and the advantage of free parking.

3.1.8 Cooperatives and markets

Cooperative societies have existed since the 19th century, and allow shareholders to receive a dividend on profits. These organisations are often run by a democratic and socially aware committee groups allowing innovative services and produce to be introduced earlier than in commercial retailing.

Interest in local produce and aversion to large scale retailing has allowed a rejuvenation of market selling, particularly for food produce and "Farmers' Markets". Supported by romantic notions of tradition and rural charm imported from the continent, this retail form encourages local participation and repeat trading and the sense of well being generated.

3.1.9 On-Line Shopping

The internet has been a major development of the late 20th Century and whilst not freely available universally, access has become available to the greater part of the purchasing public, and most significantly to the more affluent groups, expanded further by broadband high speed connections. This has been most profound in its erosion of the concepts of threshold and range, and in the revolution of on-line auction sites where goods are bought and sold at the price the buyers market sets and the goods are transported anywhere in the world. The availability of price comparison web-sites has also arguably radicalised how traditional comparison goods stores needed to be geographically grouped for the convenience of the customer, now it is possible to go straight to the best priced item, and even order it direct, without the need to make a journey at all. An increasing number of food stores offer home delivery, and many on-line retailers offer discounts on internet sales due to the savings in overheads.

There was some concern in the early 21st Century that the internet phenomenon would spell the end for actual shops (Dixon and Marston, 2002). The industry has responded by increasingly providing an entertainment destination such as Nike Town in London, and offers and experiences that appeal to the psychology of the shopper that cannot be recreated on-line such as rooting through acres of rails of end of line stock for that chance bargain find at TK-Max or an outlet centre. Or the pleasure and image building of seeing and being seen in high-class stores in the fashion streets of London.

3.2 Retail theory and retail architecture

This section considers the retail industry through the theories and strategies for retailing that are documented in the literature. Miller (1998, p53) defines three areas of research and literature; Functional retailing theory, Sociological discussion and commercially orientated classification of shopping behaviours. This is perhaps too narrow, and the nature of planning theory should also be considered as it as such a major influence on urban forms. Financial and marketing theory support retail strategy and store design. Architectural retail theory would seem to be related to the sociological discussion, however the literature is distinct in its limitation to either issues of observed consumerism and behaviour or style and aesthetics. As the core of this research, environmental retail theory must also be included.

3.2.1 Urban Morphology Theory

Location is one of the most significant factors for the retailer. When seeking to develop a store in existing premises in a mall or high street, retailers put a great deal of effort into the selection of the right property, with a good frontage to depth ratio and the location. Retailing in the UK has been studied in depth by geographers in terms of development of the town centre, land use and associated transport patterns. Christaller's *Central Place Theory* has traditionally been used to attempt to understand retail form, and to explain economic forces. This theory holds that goods have a *threshold* population to make the supply of the good worthwhile and a *range* distance that consumers are willing to travel to obtain the good. O'Brien and Harris (1991) report that this theory is applicable historically before the 1960's. Alonso's *Bid-rent theory* (Dixon, 2003) is used in explaining urban morphology where a relationship exists between rent value per square metre, linear distance from highest land value and type of goods sold. Analysts traditionally treated convenience and comparison goods as separate retail groups, but the product range of the major supermarket chains has resulted in their share of the comparison market growing rapidly.

A1 Shops
Shops retail warehouses, hairdressers, undertakers, travel agents, post offices, pet shops, sandwich bars, showrooms, domestic hire shops, internet cafés and funeral directors.
A2 Financial and Professional Services
Banks, building societies, estate and employment agencies, professional and financial services and betting offices.
A3 Restaurants and cafes
Use for the sale of food and drink for consumption on the premises.
A4 Drinking Establishments
Use as a public house, wine-bar or other drinking establishment.
A5 Hot food takeaways
Use for the sale of hot food for consumption off the premises

Figure 3-4 Retail Use Classes

Categorisation of retail operations has been made by the Town and Country Planning (Use Classes) Order (1987) and amended in 2005 is shown in Figure 3-4. These classifications are used to define the use that might be appropriate in speculative development and local authority urban zone planning for retail. Unique uses classes (sui generis) fall into none of the listed classes and include such as laundrettes, taxi and car hire, retail warehouse clubs, and vehicle showrooms.

3.2.2 Financial Theory

High street shops in small towns have traditionally been rented on a system which subdivides the unit to three zones, the first zone is at the primary rate, the second zone is worth half that and the rear zone is only worth a quarter of the rental value (Morgan, 1988). The divisions vary geographically with a 9 metre zone length in London and Scotland, 7.5 metres in Northern Ireland and 6 metre zone length elsewhere (Figure 3-5 Rental Value). Any space beyond three zones is of dubious retail value or rented at an eighth of the rental value. This provides the convention is that the ideal retail form is three times longer than the width (Figure 3-6).

Agreement to lease is usually 25 years because VAT could be reclaimed on professional fees for leases of this length. Rental review normally occurs at five year intervals, which allows a retailer to withdraw at five years. This may have a strong connection with patterns of refurbishment and relocation in retailing. The landlord will often offer a lease free period, or a cash incentive to lease to encourage retailers into a new shell development (Morgan 1988), these payments can sometimes cover as much as half of the construction cost. Rental costs have increased significantly in the last two decades, in 1988 a typical anchor tenant would pay £4-10 per square foot (sqft) of net retail space and £7million to fit out 120,000sqft of retail space (Morgan 1988), today they would spend £10million but the rental rate is nearer £70-100sqft. With annual retail rental value growth rates forecast at around 2.5% until 2008 (Grimley 2005), developers and land agents must strike a fine balance between the shell cost and the rental return to ensure the revenue will cover the capital costs. If rental rates become too high to be sustained by the retailer's turnover, which is in turn dependant on the traditional market model, the development will become commercially unviable.

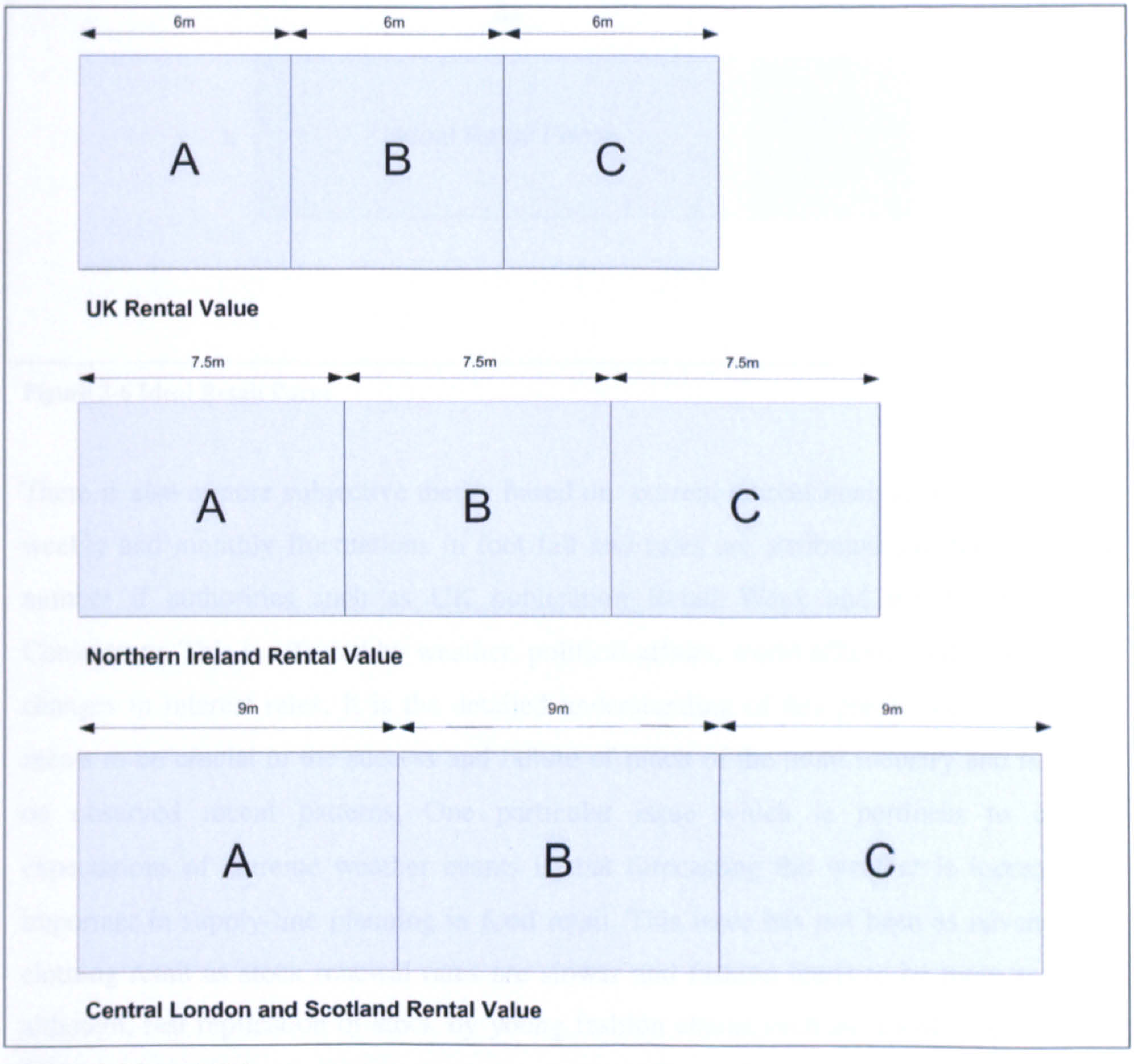


Figure 3-5 Rental Value

3.2.3 Marketing Theory

Marketing theory is essentially management of budgets and projection of sales based on current and predicted market conditions. The traditional market model (Figure 3-7) dictates the most basic law; price (which includes the costs of overheads and profit) quality, supply and demand or "*market equilibrium*" (Lavender1990; Hanley and Spash 1993).

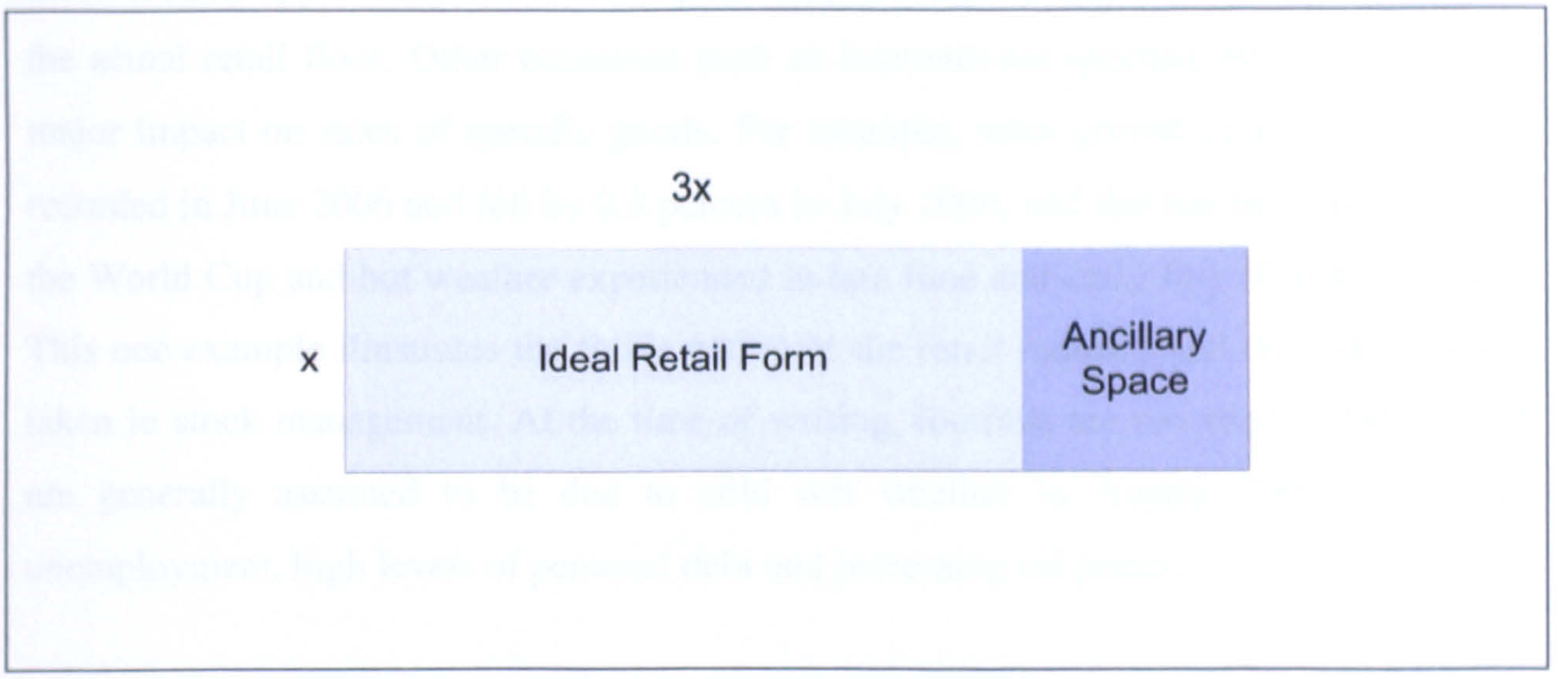


Figure 3-6 Ideal Retail Form

There is also a more subjective theory based on current market analysis to which daily, weekly and monthly fluctuations in foot fall and sales are attributed and reported by a number if authorities such as UK publication Retail Week and the British Retail Consortium. This is affected by weather, political affairs, world affairs, media events and changes in interest rates. It is the detailed understanding of this predictive science that seems to be crucial in the success and failure of much of the retail industry and is based on observed recent patterns. One particular issue which is pertinent to current expectations of extreme weather events is that forecasting the weather is increasingly important in supply-line planning in food retail. This issue has not been as advanced in clothing retail as stock renewal rates are slower and fashion tends to be more seasonal although, fast replication of stock by young fashion chains such as H&M, Topshop and New Look compete with supermarket clothing lines, George at Asda and Fred & Florence at Tesco to meet customer demand for fashion lines updated weekly. It is common for retailers to blame unseasonable weather for poor sales and mark-down on seasonal clothing blocking the introduction of more appropriate stock. Solomon (2003) claims that clothing retailers will begin to follow the lead of food retailers once they have overcome the issues of treating the nation as a single area rather than looking at localised trends and begin to use more sophisticated and multiple weather forecasting sources. Research by Datamonitor (Solomon 2003) suggests that clothing retailers are missing

5.7% of sales opportunity due to inadequate supply line planning and offer positioning on the actual retail floor. Other occasions such as international sporting events can have a major impact on sales of specific goods. For example, sales growth of 0.7 percent was recorded in June 2006 and fell by 0.3 percent in July 2006, and this has been attributed to the World Cup and hot weather experienced in late June and early July (Chisholm2006). This one example illustrates the fickle nature of the retail industry and the risks that are taken in stock management. At the time of writing, footfalls are recorded as falling and are generally assumed to be due to cold wet weather in August 2006, increasing unemployment, high levels of personal debt and increasing oil prices.

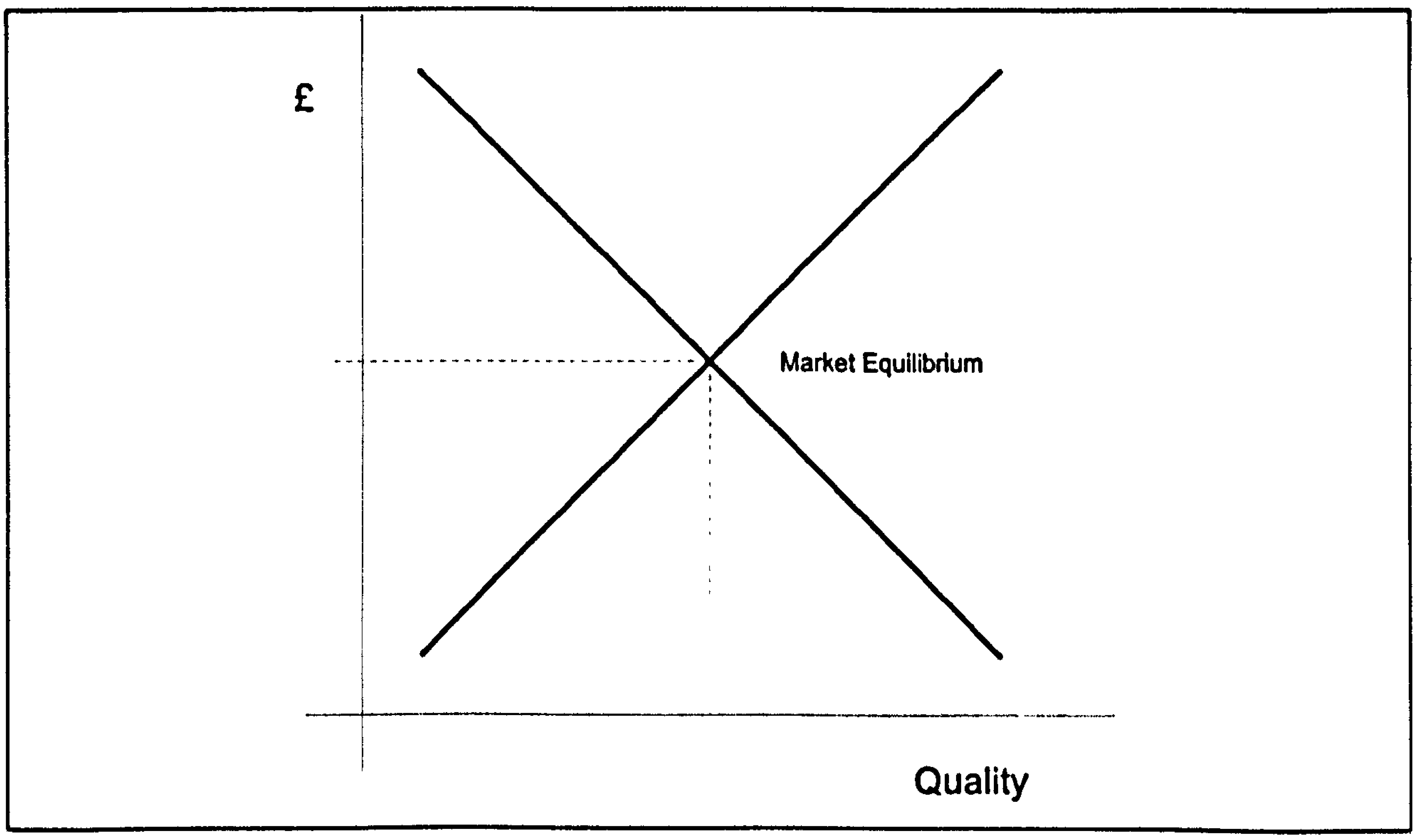


Figure 3-7 The Traditional Market Model

3.2.4 Sociological Theory

Without customers, retailers would be unable to operate. Therefore, providing for the needs of customers is very important. Firstly their behaviour needs to be understood. Secondly their legal requirements must be met. Thirdly, the retail environment must provide the vital interest that allows the retailer to be set above their competitors. Much research has looked at food shopping behaviour, less so at fashion and lifestyle shopping behaviour. Customer classification is the main reference of retail marketing. The problem with these classifications is their tendency to change over time as demographic structure changes. Forecasting of demographics is therefore an important strategy. Repositioning of the offer, differentiation between competitors in a similar group and branding (recognition and re-enforcement) are the main tactics used in this competitive world. Bluewater have divided their visitors into cluster groups based on attitudes rather than demographic traits, Table 3-1.

Explorers	**Conformists**	**Discerners**	**Traditionalists**
Aspirational and goal orientated Driven by wants and are impulsive Attracted by fashion brands	Influenced by peers Loyal to mainstream brands Will buy more rather than better Family focused Time poor	Seek individuality and exclusive brands Service and convenience orientated Empty nester Usually aged 50+	Strong need to tradition and community Prefer things not to change Traditional British brands
24% of population	17% of population	8% of population	18% of population
24% of spend	19% of spend	13% of available spend	19% of available spend
33% of visitors	28% of visitors	8% of visitors	16% of visitors

Table 3-1 Bluewater visitor cluster groups (Source: Bluewater 2006)

A survey in 2006 by Mintel reported that only 16% of the British public like shopping and that inefficient circulation and lack of fitting room space are major issues particularly to women and older shoppers and younger shoppers prefer the experiential lifestyle browsing of shopping (Glaser 2006). Of course, shopping occurs to provide necessities of food and clothing to allow life to be sustained, however expectations have increased beyond a level of mere subsistence. Miller asserts that the ordinary person expects to gradually increase their standard of living through consumption of things for life activities, i.e., clothes for school, equipment for sports, furniture for domestic arrangements, and also recognition of need to demonstrate love through the gifting of such items to others. This process will elevate the shopper through the customer classification system. Shields (1992) argues that shopping is beyond functionality, and consumption has become a social and communal form of solidarity. Langman (in Shields 1992) asserts that by the age of five, many children already have a good understanding of the cultural practices of shopping, and peer group expectations (Sheilds, 1992). There is also evidence that they can name and sort various brands by their logo at this age.

Ideas of value are central to the psychology of shopping. Shields (1992) suggests that the post-modern consumer clearly understands the arbitrary nature of the exchange value of goods they purchase. Miller (1998) suggests that three forces are at work in this evaluation; social, economic and moral. Cost benefit analysis using calculations far more complex than could be carried out on paper by the customer in an almost subconscious manner and that customers can simultaneously compute "three intersecting equation to compare the value of special offers on a variety of brands in the supermarket. Perceptions of value can be easily comprehended by the customer by simple differentiation, the cheaper a product is, the larger and brighter is the graphic and paper label attached to it; the smaller the print of the price, the less the customer feels comfortable making and effort to read it, and ultimately, there are no prices displayed at all, giving the customer the subtle message that needing to ask for the price, excludes them from the sort of customers expected. Likewise, the quality of staff is also reflected in the quality and price of the product.

Secondary (although this is only because of the service sector nature of retailing) is the social group of the employees. This group also has legal requirements, and the retailer has an interest in their well-being to promote longer periods of employment and greater productivity. The customer is given the sub-conscious message that they are paying for this service through the price tag. Exclusive brands expect repeat custom, and good staff, often career retailers, learn to anticipate and attend the customer well. The cheap end of the market employs much younger, cheaper labour on short-term contracts; they may be largely untrained and ignorant of their product and the requirements of their customer. These are of course sweeping generalisations, but as customers, these are situations that are familiar to us all. The perception of the company and their staff policies is an area where sustainability is increasingly an issue. Staff volunteering and community projects are increasing, and accessibility to Corporate Social and Environmental Responsibility policy through web sites allows staff and customers to observe the gap between policy and reality. Pressure from staff for business to change their practices is thought to be an increasing influence on corporate responsibility (Gilbert, 1999).

3.2.5 Aesthetic Theory

There is not a great deal written about retail architecture from the point of view of architectural aesthetics and conceptual ideas. It could be assumed that this is because it is considered to be insufficiently intellectually considered. This belief needs to be challenged; retail architecture at its best is as powerful as the best religious architecture for its ability to manipulate and move the unknowing visitor unto the retailer wishes. "*...design is for the most part in our consumer society a useful tool to enhance sales.*" (Ritchie, 1995, p31). There is an amount of literature that surrounds the artifice of retail aesthetics; Monumental architecture is common; soaring arches, expensive finishes and sculpture and tropical gardens, multiple leisure uses, cinemas, ice rinks fairgrounds etc. (Shields, 1991). The mall is viewed as a modern day temple or cathedral to consumerism. Others look at the psychology of acquisitional behaviour and the "*fantasy element in aesthetic treatment, the psychology of wishing*" (Ferguson in Shields, 1991 p32). The mall becomes a stage for self-presentation, the individual imagining they are being seen by a camera, and attempting through personal affects and styling to project the image they desire to be defined by. (Langman in Shields, 1992). In the same way a shop is an experimental stage to assess purchases against the consumers self image. (Beng in Sheilds, 1992)

Retail interiors may also be linked to aesthetic styling in fashion magazines (Beng, in Sheilds, 1992) through the presentation of an image that sections of society may choose to aspire to. Although this relationship between a monthly editorial of the latest trends reflects on the merchandise being sought by customers, and the window displays presented, the shop aesthetic must allow this short-term change to continue against a backdrop which captures a more enduring set of ideas about the quality and customer profile a shop expects to attract. This gesture supports the image making intent of the consumer and has led to the success of designer labels. It has also helped to ensure the success of high quality outlet shopping.

The aesthetic and design of a store is also associated with the stock and turnover expected and the segmentalisation of the customer. Interior design tends to concentrate on two descriptors; look and feel. The look of the store describes what cultural or style references are being employed the feel describes the quality and image that the concept is meant to portray. An example might be a sports shop having the look of the inside of a sports stadium at night, with large flood lights, a blacked out ceiling and a floor finish reminiscent of external landscaping elements such as artificial grass and stone. At the same time the feel is of value for money and wide variety of choice (also known as the "Pile it high sell it cheap" principle). Ideas such as procession through the store and series of rooms help to lead customers through a journey of discovery, particularly popular in young and high women's fashion. This is supported by a junk shop/vintage aesthetic in fashion that is frequently revisited and seeks to make the customer feel that they are on a form of ceremonial hunt for the trophy garment or "find". Others prefer to keep displays very minimal, or display in quirky forms in the manner of an art gallery suggesting that the customer is buying into an artistic or trend setting image. A third method is to lay out the product in a very clear and orderly manner, grouped by type of garment or occasion in the case of clothes (i.e. suits in one place, underwear in another). This last is the normal theme of small and all own ought department stores and is directed at the busy shopper, perhaps families or working women, where the job in hand is to find, try on the product and purchase it with the minimum of time and fuss. This is the usual method used in Supermarket clothing departments. Very large department stores employ a different method with concessions, where each small subdivision is detailed and finished by the concessions design and construction team in the manner of an exhibition hall or "displaying the offer" like a series of stall holders at a well ordered market where the concessions are then grouped according to lifestyle classifications within a minimal backdrop of the overall store style.

Trying on clothes in a comfortable environment is very important. Lighting, colour rendering, a seat, a hook, mirror angles and positions, sense of privacy and comfortable temperature are key elements to the encouragement of purchasing. The threshold on entering a store to change from travel mode to shopping mode provides an important point to illustrate the nature of the retail offer. Busy stores prevent shoppers from really seeing the merchandise on display as they divert attention to avoiding collisions with other shoppers (beta consciousness) and reducing processing visual information (alpha consciousness) These ideas are supported by graphics and music to create and vary mood (Gibson, 1999).

3.2.6 Environmental Retailing Theory

The environment does not have a powerful voice in retail decision making unless legislation or action groups act on its behalf. These factors should be in the interests of everyone, however, in the short term they tend to interfere with economic issues such as uniform supply of goods and capital cost/m2 and social factors such as low price and choice of goods. Commoner (1992) points out that market driven economies can create markets for seemingly environmentally benign products, but only at vast profit to the supplier. For this reason it can be assumed that retailers would find a concentric model of sustainability much more applicable to their enterprise (Figure 3-8 Concentric model of sustainability) as it allows the needs of sustainability to be managed in a sequential manner rather than attempting to balance complex demands in the triangular model demonstrated in chapter 2.

Two environmental retail strategies exist; established retailers pursuing more responsible policy, market share and image, and environmentalists taking up an enterprise to fill a market gap. Food sales are increasingly affected by public opinion on fair-trade, GM free produce, farm assured, cruelty free, seasonal, organic produce and local sourcing. Sales of organic foods in Britain have been seen to more than double over the past five years and sales at £1.2 billion in 2005 (Butler, S 2005). At twice the rate of general grocery sales, this sector gains £2millon of sales every week, but only account for 2% of all food sales. The Co-op conducted a survey in 1994 and 2004 asking consumers about their attitudes to food (Co-operative Group, Attitudes to Food, 2004 www.co-op.co.uk). This demonstrates that attitudes to these issues have changed dramatically in the last ten years. This process has been aided by the introduction of voluntary and government labelling schemes. Despite having a clothing and house wares business too, the Co-op has not begun to tackle this area. Ethically sourced, organic and recycled fibres in fashion retailing are beginning to have a place in mainstream chains. The Ethical Trading Initiative (ETI) has developed a code of conduct which retail suppliers can sign up to. This code aims to protect communities in source countries where low pay, contact with hazardous dyes or chemicals on source crops such as cotton and underage workers are issues of concern. Not only are consumer decisions a compromise between the often conflicting needs of several people in a family group, but also that there is a tendency for the first example to exist in all of the groupings if peer pressure exists. In Japan, consumer demand is very high, due it would seem to a number of religious and cultural reasons; desire for the *New*, inspired by Shintoism, the reciprocal giving of gifts and the need to dress in a manner fitting the company, season and occasion and status in order to maintain face. (Clammer, in Shields 1992).

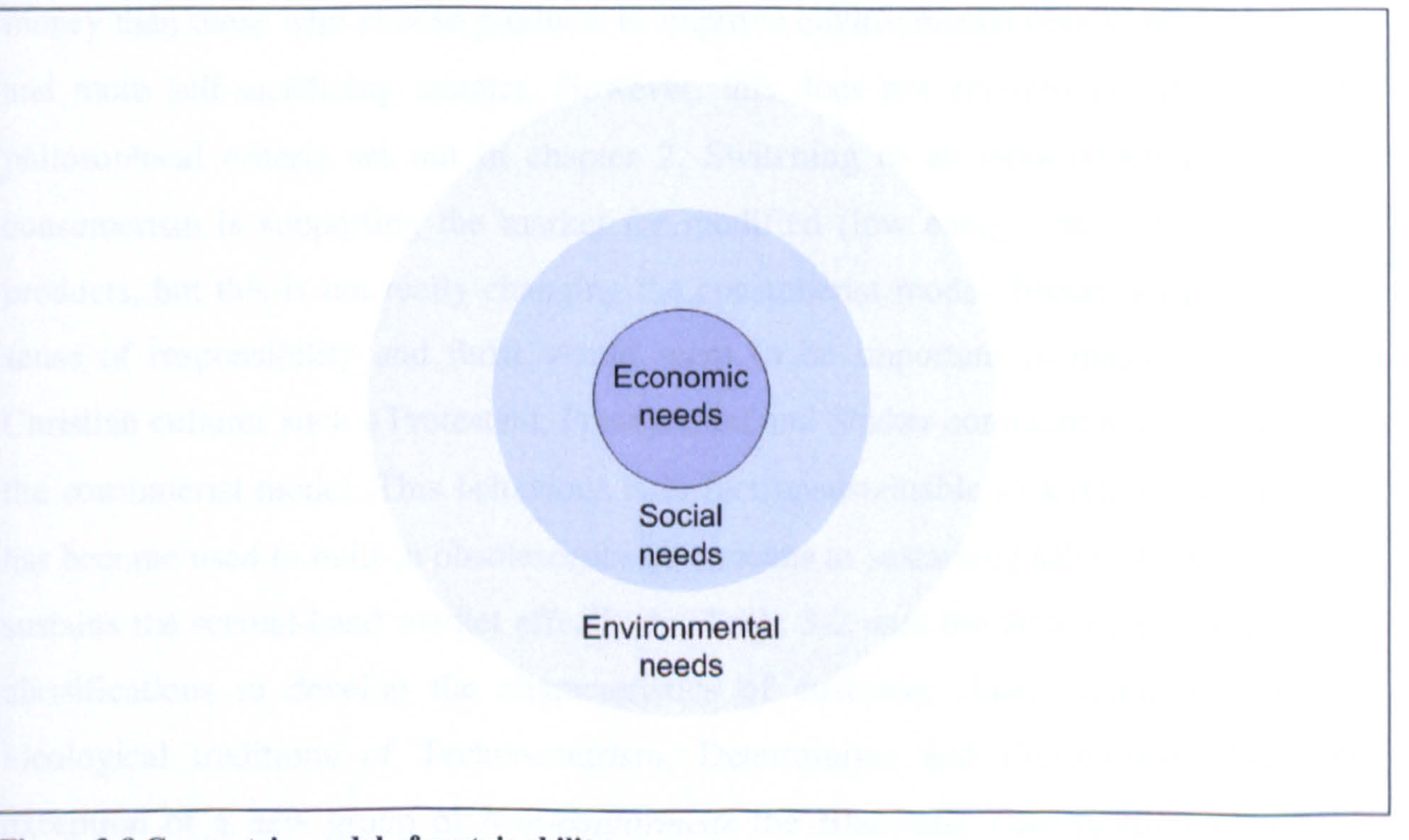


Figure 3-8 Concentric model of sustainability

Ideological grouping	Technocentric		Deterministic		Ecocentric
Attitudes and traits	Buys the newest available technology Replaces technical goods regularly Buys to compete and impress	Buys to save money in the long term (quality) Buys to save energy in-use for financial reasons Buys what parents would approve of (even if deceased) "waste not want not"	Buys to be socially responsible Buys Fairtrade goods Buys Charitable products Buys regularly for children and gifting purposes	Buys locally made and craft products Buys organic for health reasons Buys at farmers markets Buys quality products for appreciation of the taste, longevity or maintained value	Buys second hand Buys with non-monetary exchange Buys organic for environmental reasons Avoids brands and corporations
Bluewater classification	Explorers	Traditionalists	Conformists	Discerners	*Non-conformists*

Table 3-2 Customer Classification for Environmental Retailing

According to O'Brien and Harris (1991), customer demand is led by two groups, those who use environmental merchandise as a status symbol and are prepared to spend more money than those who choose products to improve environmental conditions in a quieter and more self-sacrificing manner. However, this does not encompass sufficiently the philosophical criteria set out in chapter 2. Switching to an environmentally directed consumerism is supporting the market for modified (low energy, recycled or smaller) products, but this is not really changing the consumerist model. Moral obligation and a sense of responsibility and thrift would seem to be important in many Western and Christian cultures such a Protestant, Presbyterian and Shaker communities and counter to the consumerist model. This behaviour is in fact unsustainable to a retail market which has become used to built-in obsolescence as a means to sustaining sales of a product, but sustains the second-hand market effectively. Table 3-2 uses the Bluewater cluster group classifications to develop the characteristics of customer classification to meet the ideological traditions of Technocentrism, Determinism and Ecocentrism. With the exception of a new group of *Non-conformists* the Bluewater classification provides a good comparison. It could be assumed that the Non-conformist group may have a very small available spend and are unlikely to be visitors to a major shopping centre and therefore are such a small group, that they are of no interest to retailers.

Successful retailers know above all else how to market products and services, the key aspect of this theory would seem to be how they can communicate their ethical validity to their customers to differentiate themselves from their competitors. Retailing must respond to changing socio economic patterns. "*The future of retail is about empowering consumers and retailers to use the mass of information and choice they now have to hand*" (Mistry, 2002 p15). It could be asserted that the majority of retailers are only just beginning to disclose CSR policy that is transparent enough for customers to do this Barry, 2003). The following diagram attempts to demonstrate how sustainability or environmental commitments in corporate responsibility policy might affect traditional marketing theory. Sustainability can be translated into a business model as the Triple Bottom Line concept (economic cost, social cost and environmental cost).

Gibson (1999, p308) has defines four business strategic levels to respond to social and environmental concerns;

1. Non-compliance – limiting cost and short term difficulties by ignoring change
2. Compliance – Accepting change when pressured
3. Proactive Compliance - applying change a head of new legislation to obtain competitive advantage
4. Social and ethical leadership – striving for best practice as a pivotal part of business.

Parallels can be seen between this strategic view and the measure of effort or profundity defined in chapter 2.

Corporate Responsibility reporting reports on the activities of a whole business enterprise, not specifically each building, although the report would require collation of data from each retail premises as well as storage and office facilities. Business in the

Community (BiTC) has developed guidelines for this procedure and identify three categories;

- Level 1 : companies just beginning to measure progress; requires mostly baseline data
- Level 2 : companies wishing to move beyond a basic commitment; requires some performance and impact data
- Level 3: companies aiming at further improvement of their performance; requires qualitative as well as quantitative information.

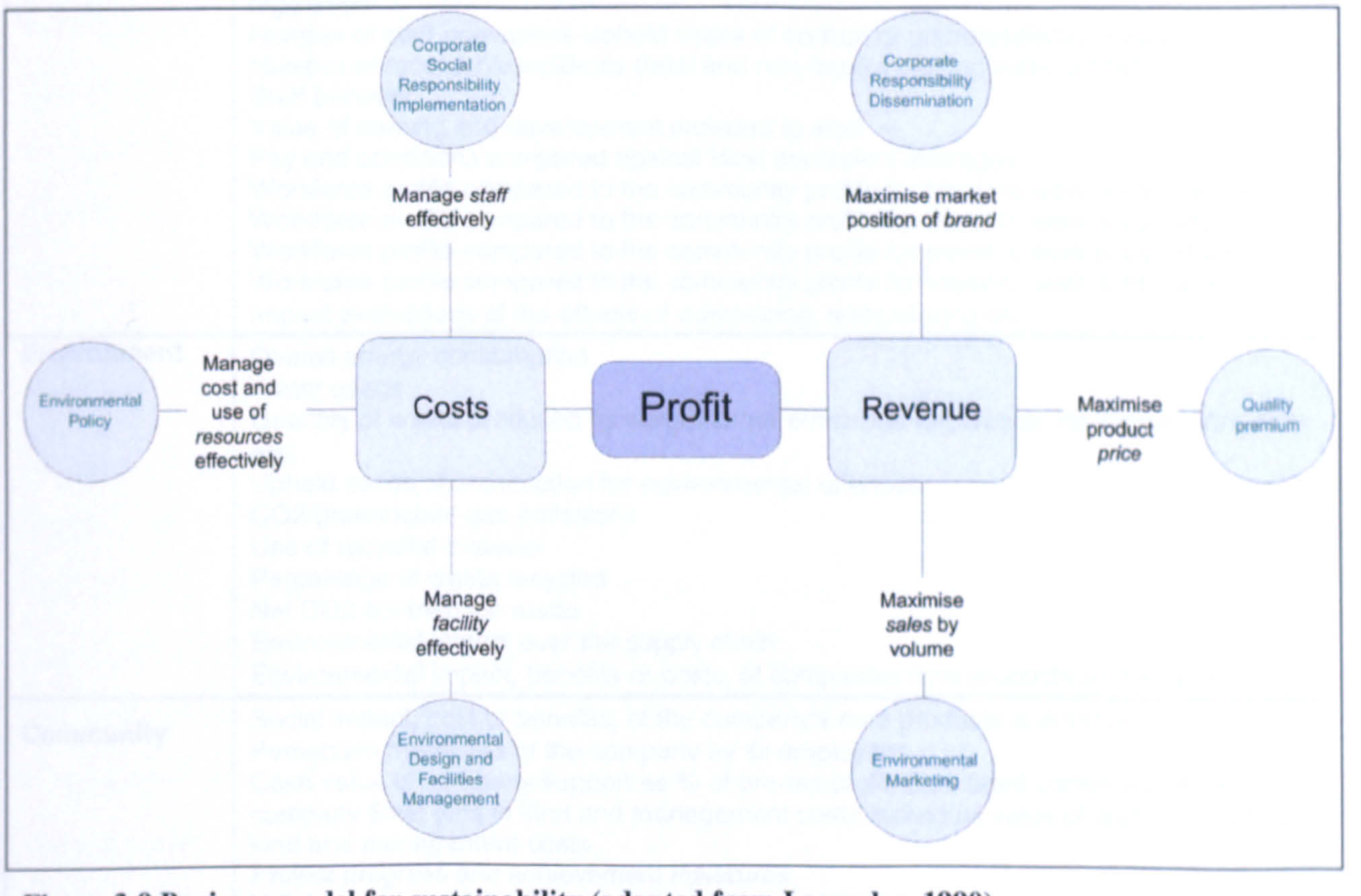


Figure 3-9 Business model for sustainability (adapted from Lavender, 1990)

These represent a direct comparison of reporting with the three levels of profundity identified in chapter 2 active, pro-active and industry leadership in that the passive level of profundity would not represent the voluntary nature of corporate responsibility as defined by the EU in chapter 1. The format shown in table 1 provides headings for written reporting only however, and does not offer comparable measurement except year on year changes within an organisation. BITC also offer a service to business where they respond to the report with suggested areas for improvement.

Marketplace	Customer complaints about products and services Advertising complaints upheld Recognizing and catering for diversity in advertising and product labelling Complaints about late payment of bills Upheld cases of anti-competitive behaviour Customer satisfaction levels Customer retention Provision for customers with special needs Average time to pay bills to suppliers Customer loyalty measures
Workplace	Workforce profile - gender Workforce profile – race Workforce profile - disability Workforce profile - age Staff absenteeism Number of legal non-compliances on health and safety and equal opportunities legislation Number of staff grievances Upheld cases of corrupt or unprofessional behaviour Number of recordable incidents (fatal and non-fatal) including sub-contractors Staff turnover Value of training and development provided to staff Pay and conditions compared against local equivalent averages Workforce profile compared to the community profile for travel to work area - gender Workforce profile compared to the community profile for travel to work area - race Workforce profile compared to the community profile for travel to work area - disability Workforce profile compared to the community profile for travel to work area - age Impact evaluations of the effects of downsizing, restructuring etc
Environment	Overall energy consumption Water usage Quantity of waste produced by weight Other emissions (eg Ozone, Radiation, SOx, NOx etc) Upheld cases of prosecution for environmental offences CO2/greenhouse gas emissions Use of recycled material Percentage of waste recycled Net CO2 contribution made Environmental impact over the supply chain Environmental impact, benefits or costs, of companies core products and services
Community	Social impact, cost or benefits, of the company's core products and services Perception measures of the company by its employees Cash value of company support as % of pre-tax profit, Estimated combined value of staff company time, gifts in kind and management costs Individual value of staff time, gifts in kind and management costs Project progress and achievement measures Impact evaluations carried out on community programmes Leverage of other resources Perception measures of the company as a good neighbour
Human rights	Any upheld non-compliances with domestic human rights legislation Existence of confidential grievance procedures for workers Wage rates Progress measures against adherence to stated business principles on human rights as stated by UK law and international human rights standards Proportion of suppliers and partners screened for human rights compliance Proportion of suppliers and partners meeting the company's expected standards on human rights Proportion of company's managers meeting the company's standards on human rights within their area of operation Perception of the company's performance on human rights by employees, the local community and other stakeholders

Table 3-3 CR benchmarking criteria (source: BITC 2006)

These key indicators are aimed at businesses, some of which are retailers. Whilst certain issues are pertinent to the development of new facilities they cannot be directly transcribed for use by the retailer's design team, it is relevant that the criteria are considered.

How the retail corporation responds to the needs of its employees and customers is a major marker of their commitment to society and the environment. Corporate theorist Barrett (1998) recognises a seven level hierarchy of organisational and environmental consciousness, survival/health and safety, Belonging/emotional welfare, Self-esteem/goal-orientated, Transformation, Organisation/internal Correctedness, Community/contextual connectedness, Society/ecological wholeness. Common good is represented beyond the transformation stage. It could be argued that transformation beyond self-interest is a significant stage that once passed by an organisation cannot be reversed, it is the start of the move from the passive approach towards industry leadership. Barrett describes this process of transformation as a move from dependency on the external world and fears of not having enough, being safe and respected to find satisfaction (*object-referral* in the self conscious) to finding satisfaction from internal sources (*subject-referral*). Personal transformation can conflict with corporate transformation; however this transformation point, caused by a number of events forces the individual to act in service and making a difference. In a corporation, the entire community must all be free of fear (issues which are supported by corporate social responsibility of the corporation) to allow the corporation as a community to move towards industry leadership. Barrett's principle supports the distinction between passive stance, and the, and successive three levels of profundity (active, proactive, industry leadership). This would suggest that the key to moving from passive to active requires a transformative event in the project team or retail organisation. The retailer must gauge corporate consciousness to align with staff and customer needs to remain economically sustainable and it is this relationship with marketing theory that requires a company to make accurate CR reports that are neither misleading nor overstated. The external stakeholders must be put into a position to trust CR documentation and the motives of the corporation in the way they present and carry out their commitments to continue to trade with them. There may be evidence of an imperative towards change in some organisations although it is difficult to ensure credibility against the promotional value which is attached to Corporate Responsibility. This could be aligned with Barrett's (1998) *Transformation* towards common good. This may be dictated from senior level or demanded by staff or forced by external stakeholders such as customers or campaigners. Changing the mindset of retailers through transformation and moving towards significant sustainability is probably the biggest hurdle in the attempt to make retail facilities more sustainable. Construction industry professionals cannot force this change, but an attempt to lead by example could be effective. It could be argued that the most effective transformation is external pressure although there will inevitably be a level of inertia.

3.2.7 Published Examples

Buildings and interiors may have a smaller part to play in green retailing in terms of overall impact, but they are the part most easily controlled aspect of the retail business in the long term and are the more specific subject of this research. There are some published examples of environmental retail architecture.

RIBA Award winning Sainsbury's in Greenwich designed by Chetwood Associates was the first supermarket to with a strong environmental brief in the UK. Natural lighting to the sales floor was provided by roof lights so no daytime artificial background lighting is required, solar gain is prevented by computer controlled louvres which also prevent light pollution at night. Display lighting is used only at product level. A gas-fired combined heat and power plant generates electricity, reducing CO_2 emissions, and waste heat is used for underfloor heating. A wind turbine and solar panels generate electricity for signage and car park lighting. The shell is highly insulated using low impact products and partly earth sheltered, optimising ground cooled intake air and utilising displacement ventilation strategy. Ground water is used to provide cooling and a dump for food refrigeration heat gain. Timber cladding was a certified Forestry Stewardship Council (FSC) product. A number of recycled products were specified including tyre entrance matting mat, plastic panels in customer toilets, and gabion walls constructed of salvaged crushed concrete fill. A green transport plan was developed, reed beds treat rainwater run off from the service yard, which flows flowing into the lagoon. Landscaping has been carried out with native and drought-tolerant plants (RIBA 2006).

A new store was created in a Grade II listed banana warehouse building in Spitalfields, London, including a shop front still bearing the name of the original store. The interior was left as exposed brickwork with much of the timer also preserved and the lighting scheme used track lighting suitable for low energy lamps and also maximised the shop window daylight and some sky lighting at the rear of the store. Large cast iron radiators are used for heating and as a result of the reduced lighting scheme only ventilation is required. The designer at Checkland Kindleysides describes using found items from the site within the scheme and laying on the banana reference in some of the display strategy. The feel of the store is of a colonial or provincial 19th century men's outfitters with 21st century systems removed or hidden (Simpson, 2006). This scheme demonstrates an inversion of the normal brand differentiation seen on the high street. There is no brand identification on the outside and this allows the store to fall into a niche market which differentiates it in an entirely different way. The low technology interior should prove to be low in energy use and minimal in both maintenance and refurbishment waste and as coatings are all specified as water based, low environmental impact. Timberland also hope to make the store a community display area and information point. The apparent sincerity of this scheme is attributed to the retailer's policy on social and economic sustainability. A review of policy is included later in the chapter. It could be argued that this is an experimental approach that may prove to be commercially unsuccessful, but may be repeated as this speciality clothing market increasingly promotes the idea of lifestyle rather than pure image.

The Whole foods corporation is managed by Texan, John Mackey, who was named US entrepreneur of the year in 2003 by Ernst & Young (Little 2005). Media coverage describes the supermarket chain as an organic version of Wal*mart (Lyons 2005), with seven Fresh & Wild outlets now operating in the UK since arriving in 2004. The staff are known as team members, and have documented high levels of satisfaction in the 172 existing US stores. A new 75,000 square foot major store is being completed (to open May 2007) in the old Barkers department store site in Kensington London. Their market is aimed at the affluent and professional university educated diversity of customers who are prepared to pay more for trusted organic and fair trade products. The only competitors are small operators and farmers markets at one end of the scale and Waitrose and Tescos at the other end, both of which only stock comparatively small organic ranges. It is speculated (Butler, S, 2005 and Lyons 2005) that the size of this store will require a wider range of goods to be sold to fill the floor space and the range may need to be extended to clothes and home wares.

In non-food retail, Aveda Cosmetics brand have a policy of only using the most environmentally benign materials in their stores, including wheatboard in place of medium density fibre board (MDF), ceiling tiles made from 100% recycled newspaper, The London headquarters, the Aveda Institute has a roof garden cultivating rare species (Bhaskaran, 2003).The Body Shop has pioneered principles of environmentally benign products and packaging whilst developing a global brand from one small store in Brighton in 1976. Dedicated to promotion of socially and environmentally benign products and sourcing. They have challenged each store to account for their own energy efficiency, with a strong incentive to individual staff members, this expectation of change in staff behaviour demonstrates a deterministic approach. Whilst signing up to green energy suppliers, there is also a target to reduce 2004 total CO_2 emissions by 5% in 2006.

Performance indicators have been developed from business and management performance assessment techniques and are used as criteria to determine the success of a building. This may be calculated by means of survey, financial data or service levels as appropriate. Industry data provides an indication of how scores rank against each other, often within a peer group or notional best practice maximum. There is no standardised method for this procedure and it is therefore useful only within the peer group by which it is devised. This does however make it a specialised method ideal for use within a particular industrial sector.

3.3 Retail Architecture

This section explores the specific characteristics of the retail sector of the construction industry dealing with retail development fit out, refurbishment and maintenance and how current practice provides opportunities and barriers to more sustainable approaches to the procurement of retail facilities. The development of retail facilities is led by either speculative investors in the case of development schemes or a need established by the retailer to develop or expand a chain. Many retailers work on the principles of customer analysis and theories outlined earlier in this chapter, they might pick an ideal town or city into which they would like to gain a presence, then look for suitable sites or units to obtain. Speculative projects on the other hand are guided by planning documentation and history for the sites they identify, then using geographical and social analysis to support their proposals, seek to match the facilities that could be provided with potential retailers. There exists a network of agents and consultants that make their business out of the transfer of such information between these two parties.

3.3.1 Speculative Development

Retail Development can take a number of forms; a site may be developed for a single retailers or a number of uses which and can include entertainment and social uses as well as retail (*mixed use*). Importantly, it is a developer who is interpreting the retailers needs in a direct relationship or speculatively. Typically an anchor tenant will be introduced at the early stages of the scheme and have a large say over the arrangement of the site and building forms to suit their needs and a number of smaller units will be created to suit a variety retailers, hot food outlets and bars etc. In the 1980's these were typically in the form of large shopping centres and retail terraces, however, planning constraints have tightened on such developments and urban regeneration and infill using brown field sites and incorporation of historic structures is more common. Large mixed use schemes can take many years to gain planning consent with conditional works to the locality required and will present the longest design and construction programmes. These works are often sold on to funding institutions on completion and these may have fairly clear requirements based on insurance risks and potential revenue that can be generated in rental of the units to retailers etc. Building envelopes are typically built strictly to suit a lifetime established by the fund, 25 years was typical in the 1980's, now 40 years is the usual. Maintenance of all or parts of the envelope may be passed over to tenants as part of leasing terms. The BDP/OIRM report (1972) identified 12 factors of success for retail developments; Quality of Catchment, Service charge level, Approach (parking, signage, lighting), Circulation, Tenant mix, Security, Anchor tenants, Design, Centre Management, Promotion, Public Transport, Special amenities. Despite the age of this guide, it is still very much effective in decision making to site a new store. Once the location has been selected, based on the analysis of the above criteria, the next consideration is the relationship between location and rental cost.

Retailers are often able to negotiate a 12-month rent-free period to carry out repairs and interior fit out on an older established property on first taking the lease. This is particularly pertinent when a great deal of work is required to upgrade staff welfare facilities and shop fronts etc. In a new development, the retailer can negotiate an incentive payment towards their fit out costs by the developer. This is paid either in a lump sum or in rent credit and is sometimes nearly the full value of the fit out works (Morgan 1988). Retailers can get maximum benefit from this form of incentive if they hold out until the mall or centre management has an urgent need to fill the units before the new centre opens. This situation must be a contributory factor in the tendency for retail fit outs to have such short design lead in times.

3.3.2 Owner-Occupier

An owner-occupier retailer has control over the external envelope and site conditions, typically these are stand-alone retailers such as supermarkets, home wares and DIY stores. This procurer will have a vested interest in the envelope of the building as they will be responsible for maintenance, but may rely on standard details that meet legislative requirements; often there is a repetition of the form of the building and materials used to signify the brand. Some retail procurers will utilise the experience of a development company to build their required facility and purchase or rent it on completion. Distribution facilities for retailers are often funded this way.

3.3.3 Tenant Fit-out

Tenant retailers do not have so much control over the building envelop and are often confined by Landlords' conditions. Planning permission is often not required unless the site is in a listed building or conservation area, or requires a change of use. Permission is usually required for external shop front works and signage. These projects can vary in scale from a large and complex department store to a $50m^2$ "lock-up" in a centre or high street location. Characterised by a two-stage design process, where a concept designer develops a style and a detail designer interprets the concept to produce a finished store. There may be little or no relation between the two groups of designers. As a result, concept designs are developed without consideration for actual methods and materials, only an idea of a design statement and level of quality to be achieved, leaving the detail designer to source materials and construction methods. Project periods are dictated by economically driven pressures to open stores to specific dates, traditionally the 1st of March and 1st of November in fashion retailing (Morgan 1988) and demand regular refurbishment and concept renewal in as little as three but more commonly five to ten years. The design team conventionally develops solutions using the retailer's *Client Requirements* but it has not been common practice for any value judgments to be fully recorded unless the retailer expressly requires a report of the design and implementation process to demonstrate the value they require from their building. This is sometimes carried out in the form of "value engineering" or substitution of materials. Perceived savings at the time of construction lead to increased long-term running costs and disposal costs and may impact on visual merchandising possibilities and even affect sales.

3.3.4 Concessions

Concession fit-out projects insert a branded arrangement of display equipment and signage into a specified area within a larger store. The store will exert significant control over lighting, signage floor and ceiling finishes, and as a result the works are mostly limited to joinery and decorative wall finishes. The extent to which the brand can change the basic finishes of the store is a result of the power exerted by the brand on the store. These projects can be installed in a few hours, but may be planned for some considerable time beforehand.

3.3.5 Refurbishment

Refurbishment and re-branding projects often have more cost invested in the planning and management than in the value of the actual works themselves. They may be carried out overnight to allow the store to continue to trade and require a high degree of professionalism from the contractors team to ensure the quality and finish can be achieved and return the store to a fit state to trade from the point of view of Health and Safety and the management of product. The retailer will place a great deal of risk on the contractor in term of loss of trade. Planned maintenance also falls into this category, however that might be assumed to be of a lesser nature than a full overhaul of interior finishes that might be typical of refurbishment works. Design programmes are often very short and the materials are selected to last long enough before the next design change, and the next concept may be very different from the last. Often a concept design is created and rolled out nationally or even internationally to provide a uniform brand image, a practice that prevents the use of local materials. Lord, 1985. O'Brien and Harris (1991) has highlighted seven strategies to revitalise shopping centres; Enclosure, Increasing tenant mix and number, Restructuring tenant mix, Improving energy efficiency, Expansion and refurbishment, Improving layout and facilities and Developing marketing strategy. Such works are often carried out to improve older centres such the Red Mall at the MetroCentre completed in 2004. Although refurbishment is common, the Architects workload survey (RIBA, 2005) shows that new build makes up 75% or more of retail commissions.

Figure 3-10 Fit out tenant within a shopping centre (Source: Simons Design Ltd)

Figure 3-11 Concessions within a department store (Source: Simons Design Ltd)

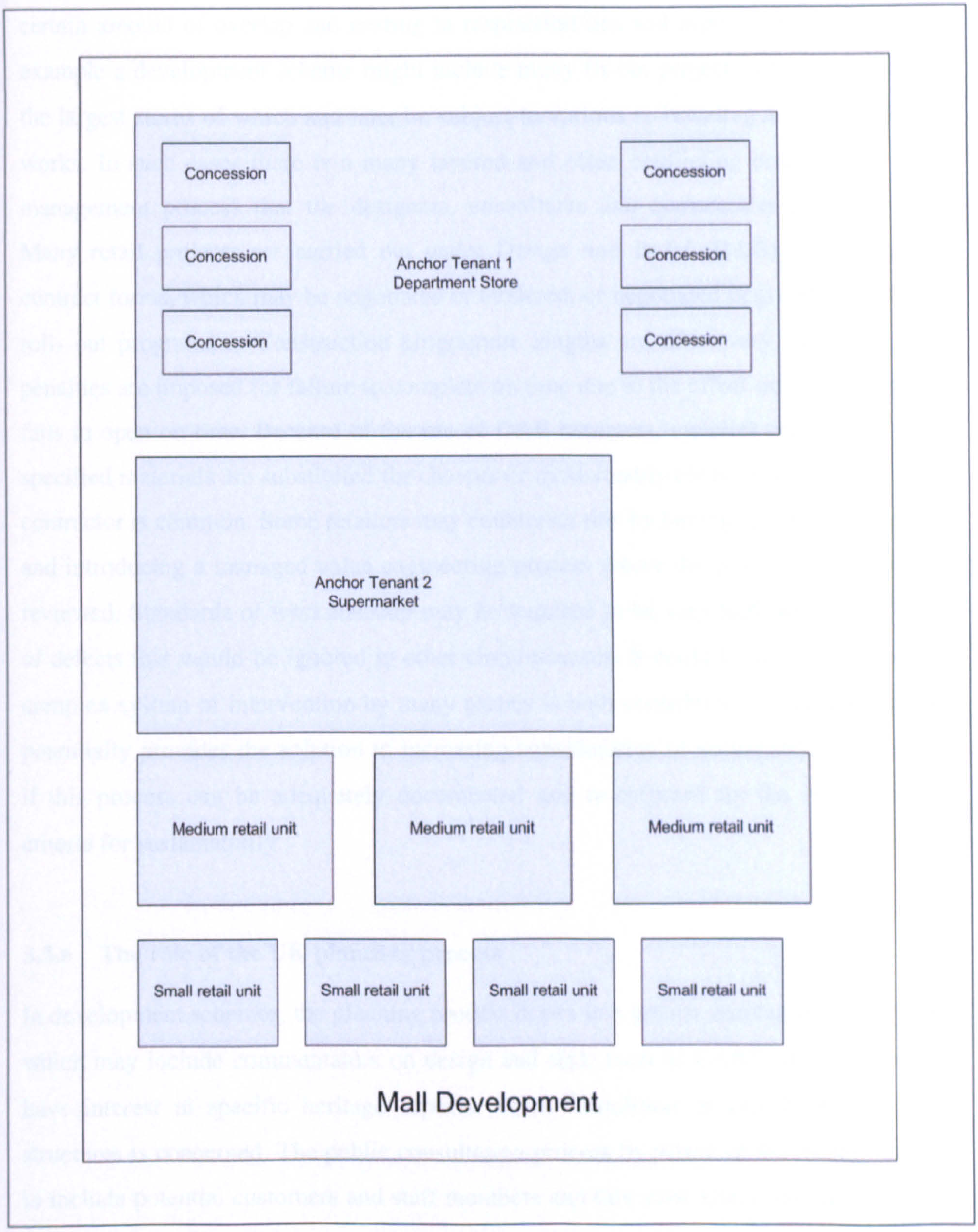


Figure 3-12 Scale and Nesting in Mall Development

All of these forms are strategic to this research, however, it can be seen that there exists a certain amount of overlap and nesting in responsibilities and aspects of the design. For example a development scheme might include many fit-out projects, and concessions in the largest stores of which and later be subject to various re-branding and refurbishment works. In such cases there is a many layered and often conflicting brief, approval and management process that the designers, consultants and constructors must negotiate. Many retail projects are carried out under Design and Build (D&B) or management contract forms, which may be negotiated or tendered, or negotiated in groups to provide a roll- out programme. Construction programme lengths are often very short and heavy penalties are imposed for failure to complete on time due to the effect on the business if it fails to open on time. Because of the use of D&B contracts, material substitution where specified materials are substituted for cheaper or more readily obtainable materials by the contractor is common. Some retailers may counteract this by having agreed specifications and introducing a managed value engineering process where the potential cost saving is reviewed. Standards of workmanship may be required to be very high with no tolerance of defects that would be ignored in other circumstances. It could be considered that this complex system of intervention by many parties is both contributing to the problem and potentially provides the solution to increasing consideration of sustainability in retailing if this process can be adequately documented and re-enforced by the intervention of criteria for sustainability.

3.3.6 The role of the UK planning process

In development schemes, the planning process draws in a greater number of stakeholders, which may include commentators on design and style such as CABE, and societies that have interest in specific heritage aspects where demolition or modification of older structures is concerned. The public consultation process by nature of the locality is likely to include potential customers and staff members and this must affect how issues such as employment and retail amenity are portrayed and understood by the public. These groups are rarely involved in the actual design process in the way in which they might be consulted in school or housing interventions. It has become more common for site based interaction to be generated with school visits and information about schemes being disseminated on notice boards or web-sites. This stakeholder interaction is closely related to corporate social responsibility policy, but is also driven by the business interests of good public relations. The government's existing planning guidance PPS22, offers local planners the discretion to demand that new developments source a percentage of their energy requirement from on-site micro-generation, and is currently being reviewed as a possible amendment to the Climate Change and Sustainable Energy Bill that would require developers to incorporate on-site renewable energy in all commercial developments over 1,000 sq m. Retail patterns have been experiencing rapid change in recent years and the planning system will need to keep a pace with these changes. Evidence published in research by Wood et al (2006) might suggest that the larger retailers will be able to exploit flaws in such legislation as has been the case with previous regulations.

In the case of fit-out projects, the planning process will often leave the planning decisions to delegated powers, which almost excludes any stakeholder dialogue with future staff and customers. As such projects tend to take less time to complete on site, public relations and corporate responsibility policy issues may not be carried out with the same level of professionalism.

3.3.7 Design Parameters in Retail

Many retailers use a concept Interior Designer or Architect who may be retained over a period of time to develop the style and look of the store and consequent chain of stores. This design may be implemented by another designer or architect and very often using a Design and Build (DB) or Management Building Contract (MC) form of contract, the design is rolled-out over a series of projects. The cost may be controlled by an agreed price per m^2 of net area and in this way the contractor takes on a great deal of risk for any unforeseen problems. More traditional forms of contract such as JCT Constructing Excellence Contract (CE) or Minor Works Building Contract (MW) may be preferred where the works include listed, or conservation area properties, and unique design schemes where the design team may wish to retain greater control on the specification and use of sub-contractors

Retailers have four design priorities, selling product, customer comfort, staff well-being and external environment. Selling product is the primary objective of a retail enterprise. The display of the product through fixtures and lighting is their foremost priority. In order to sell the product, the retail design must adequately protect the product from theft and damage and provide adequate display and storage space, lighting, IT provision etc. These requirements may be learned by the retailer through a roll out programme and testing experience in previous store, a first time client will depend much more on the experience of the design team.

It is important to remember that although the building procurer is concerned with these economic issues, the primary user of a retail development is the customer. Customers have a different perception of the retail performance, one that the retailer may attempt to understand through surveys, role-playing, experience and other in house research methods. The customer profile dictates the interior design and branding, it also positions the store in terms of level of comfort to be provided to the customer, such as toilets and baby facilities, size of fitting cubicles, signage and walkway widths etc. The retailer is required to comply with relevant standards and regulations.

The quality of service offered to the customer is also a factor of the quality of staff employed and the facilities and level of comfort offered to the staff. Again these must comply with legislative standards. The management of a facility often has no relationship with its design. Mechanisms for making handover of services and equipment such as such as operation and maintenance data and Health & Safety files do not always provide the support required for non-technical retail staff in small shops. Operational methods are very traditional, such as hot air curtain use, and keeping doors open in the summer and winter to invite trade. Many retail outlets create a large volume of packaging waste, which can be dealt with via landfill or separation and recycling. The training of staff to change a procedure is a major obstacle and makes the recycling option unpopular with store managers despite generating revenue and taking up less space. On the whole, staff costs are greater than energy savings possible at current rates. Comment should also be made here regarding trust and the concerns of retailers towards loss of stock either through staff or customer theft and how the cash desks are positioned, and exits controlled, the need for observation (either visible means such as staff and security guards or censored CCTV coverage) and constricting circulation space between the pay desk and the exit.

Naturally, retailers must comply with all local regulations such as planning and conservation area restrictions, or retailers association, in terms of signage and store front design and illumination. Higher rental value properties tend to have higher quality environments to be maintained. Concern for external environment is primarily driven by the message it gives to potential customers. There is a third party of social investors, the many bodies and organizations peripheral to the retail project that have a voice that may be powerful, such as landlords, planners, tenants and historical societies. These can control retail projects without having any financial or contractual relationship with the retailer. Conservation and planning bodies also have a great deal of control over the appearance of signage and shop fronts, more especially in historic contexts. As and example, since the Disability and Discrimination Act (DDA, 2005) and Approved Document part M (ODPM, 2004), provision for staff and customers with has begun to change many standard retail practices and design elements such as doorways in frameless glazing and minimal white interiors popular in high fashion interiors are no longer acceptable and traditional split level retailing in historic town centres is becoming very difficult to achieve economically (without the use of lifts).

Retail design often involves a number of stages of design, the retail development may have a scheme design by one team, followed by implementation by a second, possibly design and build architect. The tenant may follow this with a concept design by an interior designer which is then implemented by another design and build team and their appointed architect, if that happened to be a department store, a further layer of concession design would then also be introduced. It is easy to se that this situation can require the main retailer to employ a design agent to strictly control every stage.

Speculative shell developments provide an external envelope, which may take on any form and materials appropriate to the contextual surroundings. It is likely that wide spans will be required and this forces steel and concrete construction methods to be most commonly employed. The interior will be left in an airtight and fire proofed state for the internal fit-out to be carried out. In retail fit-out projects there are a number of major components; Wall, floor and ceiling finishes, mechanical and electrical installations, fixtures and fittings, signage and shop frontages. These may be split between a higher specification front of house sales area and back of house offices, welfare facilities and storage. Services provision (water, electricity, gas and data) will terminate at the floor or wall, and a capped soil waste pipe is provided for connection and meter installation by the tenant. Fit-out lifetime has been about five years over the last decade for clothing and shoe retailer, but the fast fashion brands are bringing this down to as little as three years (Tucker, 2006).This practice leads to a lot of discarded materials from re-fit sites. Environmentally minded contractors recycle some waste, but the economic value of this is not easily recouped by the retailer. Services are often reused, prolonging the life of less efficient equipment.

Wall finishes are commonly decorated plasterboard, or a demountable panel system. Ceilings tend to be plasterboard or grid system. Flooring types are typically carpet, vinyl, ceramic or stone tiles or laminate/solid wood. It is the surface that has the most tactile relationship with the customers and it is used to provide the image statement for the store. A large DIY retailer may use a polished power float concrete. A department store may use a variety of colours and finishes to define departments and also provide for high traffic areas. Boutiques often use real wood, either new or reclaimed planks, laminates and increasingly photographic image vinyl.

Lighting schemes in retail environments are required to do much more than provide an adequate level (between 300 and 500 lux and a minimum of 50 lamp lumens per circuit watt) and avoid glare, some retailers will have 1000lux on the sales floor. The shop windows must be lit in such a way as to draw the customer's attention, once in they must be pass through a transitional lighting area (where eyes adjust from external conditions) before being directed to look at merchandise and see it to its best advantage. Colour temperature is very important for many functions from improving the colour of not-quite-ripe fruit to allowing customers to match very dark cloth colours. In fashion retail, advantageous lighting in the fitting room is also very important. In the UK winter months and the peak trading season before Christmas, the warmth and appeal of the store from outside is so important that retailers will very keen to have either very long life lamps or very easy access ones, to ensure that they are brighter than their neighbours. Alternatively they might create drama with colour and spotlighting on specific articles, or wish to display the whole store by lighting evenly right to the back of the store. Flexibility is paramount, allowing daily and seasonal variation. Not surprisingly, lighting can be a large portion of the capital expenditure, and the bulk of the energy use. Heat produced by the lamps puts an additional load on air-conditioning plant. In severe cases, over heating display areas can suffer damage to adjacent paint finishes. Lighting is therefore one of the first items to be considered when making incremental improvements, perhaps when a retailer is trying to seek more custom, without a full re-fit. Changing lamps and fittings can make a significant impact in turnover particularly in providing side or backlit mirrors in changing rooms and better colour rendering such as warm 3000k to enliven the face (Entwistle, 2004). Reducing the amount of artificial lighting for natural lighting is known to be beneficial to the health of staff and may be help to customers who also spend a large proportion of their daily lives indoors (Lupton, 2006). Shanks (2006) reporting on lighting product and sales trends fails to note that there may be an increasing market for more energy efficient lighting products with new legislation and need for retailers to reduce electrical load. In a study by Field and Soper (1997) three high street stores were analysed for electrical consumption. The study found that sales floor lighting accounted for between one half and over two thirds of the total and air conditioning at around 100kWh/m^2. All three stores were above the best practice figures (DETR, 1994) at 345, 390 and 550kWh/m^2. Target efficiency rates were well published though conflicting in the 1990's (Figure 3-13), similar targets are no longer published by the DTI or DEFRA however it is anticipated that this will be rectified by the Code for Sustainable Buildings energy labelling system when it is published. It should be noted that these are total load figures as opposed to target efficiency rates used in AD part L2 (2006), which do not include small power use.

Premises type	Electricity kWh/m^2	Fossil Fuel kWh/m^2	Total kWh/m^2	Annual emissions kg CO_2/m^2
Post offices	45	140	185	60
	80		80	56
Banks and building societies	70	70	140	63
	100		100	70
Agencies	55	150	205	69
	90		90	63
Non-food shops	200	80	280	160 (137, 101)
	230			160
Department stores	200	150	250	200 (167, 132)
	290			200
Food stores	400	80	480	300 (234, 187)
	440		440	310
Supermarkets	670	160	730	500 (451, 318)
	750		750	530

Figure 3-13 DETR Energy Efficiency Best Practice targets 1994 (Prior, 1999) CIBSE typical and good practice targets shown in brackets for 1998 (Roaf, 2004).

Approved Document L2B (ODPM, 2006) now requires that display lighting is not used throughout retail spaces, with an element of ambient lighting being required (Entwistle, April 2006). Whilst compact fluorescent lamps and LED lighting are good low energy options, the colour rendering performance of both is poor for fabrics and organic foodstuffs. Low energy fittings are also difficult to integrate in interiors constrained by historic listing as they tend to look more modern in appearance.

Figure 3-14 Lighting and materials used for dramatic effect

(Source: Simons Design Ltd)

Figure 3-15 An example of lighting used to create atmosphere

(Source: Simons Design Ltd)

Figure 3-16 A merchandising system with integrated lighting

(Source: Simons Design Ltd)

Figure 3-17 High quality retail interior in a historic building

(Source: Simons Design Ltd)

Figure 3-18 An example of a painted ceiling

(Source: Simons Design Ltd)

Heat given off by lighting tends to increase the demand for cooling and ventilation. It is always assumed that comfortable customers will be more likely to spend longer in the store and spend more. This is particularly true when trying clothes. Many retailers use doors with no insulative value or even standing open during trading, leading to winter heat losses and summer heat gains which are combated with hot air curtains. On average 10-12% of a retail fit out is spent on air-conditioning (Silver 2006). Comfort cooling is 30% more energy efficient than five years ago, and the lifetime of about eight years in the retail environment. Clearly many much older systems will be in operation, and responsible for a large part of the energy use of the many stores. More importantly, those that use R22 coolants, banned since July 2005 will be required to be replaced due to Montreal Protocol agreements. In built up areas, the noise given off by air handling equipment is required by planning authorities to be attenuated which adds a significant cost to the installation. The Bullring in Birmingham completed in 2004 (RICS, 2003) was one of the last malls to be fully air-conditioned, it is preferred to provide a covered street, which allows the ambient temperature to be moderated to the customers external clothing. This puts added pressure on store in malls, to balance this temperature to suit staff comfort levels and provide comfortable changing facilities. His would require a weathered shop front that provides a physical barrier rather than the roller-shutter shop front preferred in malls built in the 80's and 90's and in many retail terraces. This also shifts the energy saving burden from the landlord to the tenant.

Two main types of fixturing exist; bespoke fabrications, and demountable systems. These are used to display the product and may be flexible or fixed. Flexible systems offer good opportunities for changing arrangements, but can soon become damaged. Fixed systems limit flexibility, but are easier to maintain.

Small power sources include sales equipment and computers. Music is used in many stores to create an appropriate atmosphere. This might be centrally controlled in a large chain of stores. CCTV and other security devices are commonplace, and may be responsible for some significant part of electrical load. Larger stores and hot food retailers may have catering equipment which will place additional loads on cooling and ventilation systems.

3.3.8 Conventional Performance Criteria

Typically designs are led by the *Client Requirements* of the intended user or tenant, and these will have been developed often through trial and error along with one influential design team or by a number of designers over many years.

Like all other sectors of the construction industry, a successful project is defined by its achieving performance criteria, which is for the most part defined by the retailer through a briefing process. These criteria are often linked to indicators of economic performance, which for the majority of retailers comprise the following;

- Frontage to depth ratio
- Sales floor area (net) to gross floor area
- Capital expenditure per m2
- Turnover per m2
- Number of transactions per day
- Average price per transaction
- Footfall (counting the number of people entering the store by means of a counting device fixed to the entrance doors)

It could be asserted that these traditional performance indicators must be supplemented with more ethical aspirations or counteracted with tighter regulation if there is to be any change in the present pattern of retail development. This situation stems for the evaluation of the performance of people and teams in commercial industry in what targets they meet or are worth at the present time, not what they might be worth in the future.

3.3.9 Facilities Management and Maintenance

The facilities management literature is agreed on the unique and crucial position that facilities management has in the sustainable management of any building (Hodges, 2005; Brown and Pitt, 2001; Hudson in Alexander, 2004). Retail developments such as malls, arcades and outlets are led by a speculative developer with an interest in generating rent from or sale of the completed development. Shop unit requirements are led by the tenant company with an interest in trading from that location for a certain number of years or be let on a speculative basis. Unless the lease is very long, or the property is purchased by the retailer, they are limited by landlord's restrictions and lack of incentive to make the kind of improvements that might be environmentally beneficial. Bridging this responsibility gap is crucial to the promotion of sustainability in retailing.

Increasingly large retailers are setting up responsive maintenance contracts, a valuable service to the retailer but inefficient in terms of the contractors' use of time, staff and transport. Planned maintenance is less common as many retailers take the policy to wait until repairs are necessary to avoid unnecessary expense and loss of trade due to full or partial store closure, preferring to wait until a major refurbishment or re-branding project takes place. By linking up the stakeholders in this cyclical process it could be possible to overcome the barriers that exist between the designers and facilities managers so that any good ideas better practices are not lost and mistakes repeated. Getting all these parties together is a logistically difficult exercise in terms of time and geographical location but could be much facilitated by the internet. A leading sustainable retailer could organize forums for these people to talk through their problems and seek solutions.

The Bullring in Birmingham has been a recent case of the collaborative approach to servicing (Cant; 2005). A successful scheme has been led by University of East Anglia, (CRed, 2005) has been encouraging businesses, academic and government offices to develop carbon neutral planning. The organisations and individuals involved are encouraged to make pledges to firstly lower carbon output and then encouraged to make further pledges. The scheme also extends to all new development in the Norwich area being assessed through planning applications for improvements that could be made for environmental benefits. CRed is a watchdog organisation helping others to develop sound policies in an accumulative approach, something that can be seen to be more appealing to businesses than a complete mindset and policy change. This method can be implemented at any time, not just in the design development stages. It is also fairly holistic as it encourages employees to embrace the scheme and take action to reduce carbon output in their own lives. This generates a positive environment for improvements to be maintained and possession of the policy changes by the employees. Its drawback is in the policing and management of increasing numbers of affiliates to such a scheme. It would be necessary for other Local Authority-University Partnerships to develop schemes throughout the country for wide scale implementation such as via Corporate Responsibility Reporting.

3.4 Framework for Sustainability in Retail Architecture

The objective of this section is to establish how the criteria established in Chapter 2 can be applied in retail architecture.

Philosophy can be represented by the way in which the retail business attempts to address the needs of sustainability (Figure 3-19). Whilst many retail projects may be limited by their surroundings, some common possibilities are available to the retailer to improve sustainability. Ecocentric methods of material selection for reduced environmental impact and landscaping where possible to offer benefits. Deterministic methods of people management such as bonus related targets to improve recycling, energy management, and customer involvement to engage in participatory schemes. Technocentric methods to improve equipment efficiency and control for reduced emissions (accompanied with savings on utilities), and integrating facilities management with design to ensure efficient use of space, materials and maintenance.

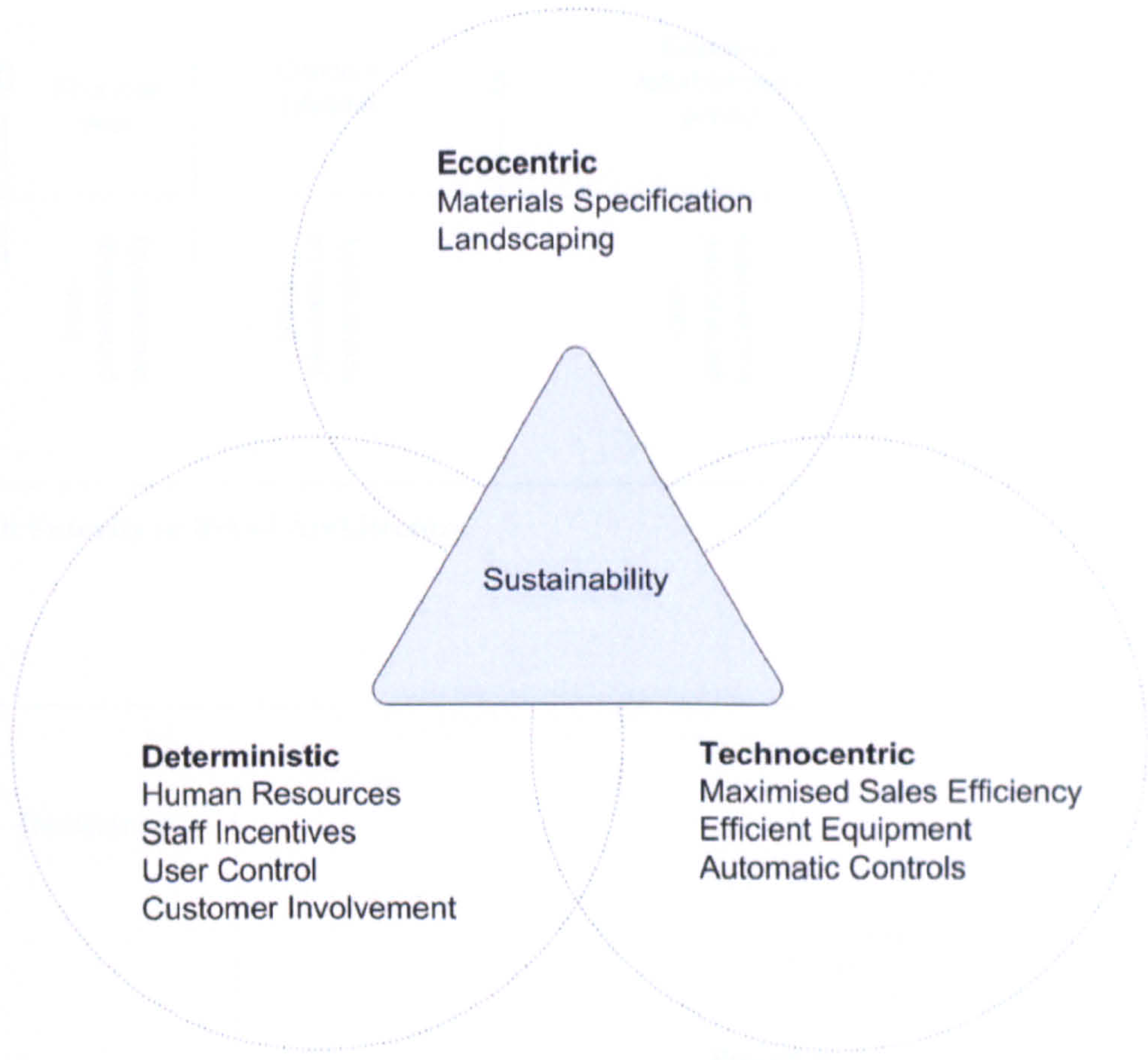


Figure 3-19 Philosophy in retail architecture

Futurity can be represented at a much shorter time frame than for other building forms. This is not to say that the building life time is reduced, just that there is an expectation of a renewal cycle at the end of the retail design life (Figure 3-20).

Profundity can be represented using the measurement of effort that was defined in Chapter 2 (Figure 3-21). However, the business strategy to changing legislation identified by Gibson (1999) must also be recognised as critical to the way retailers would differentiate themselves by establishing their brand position in terms of social and environmental awareness. As such the effort required is rewarded by more than just the moral and ethical standing.

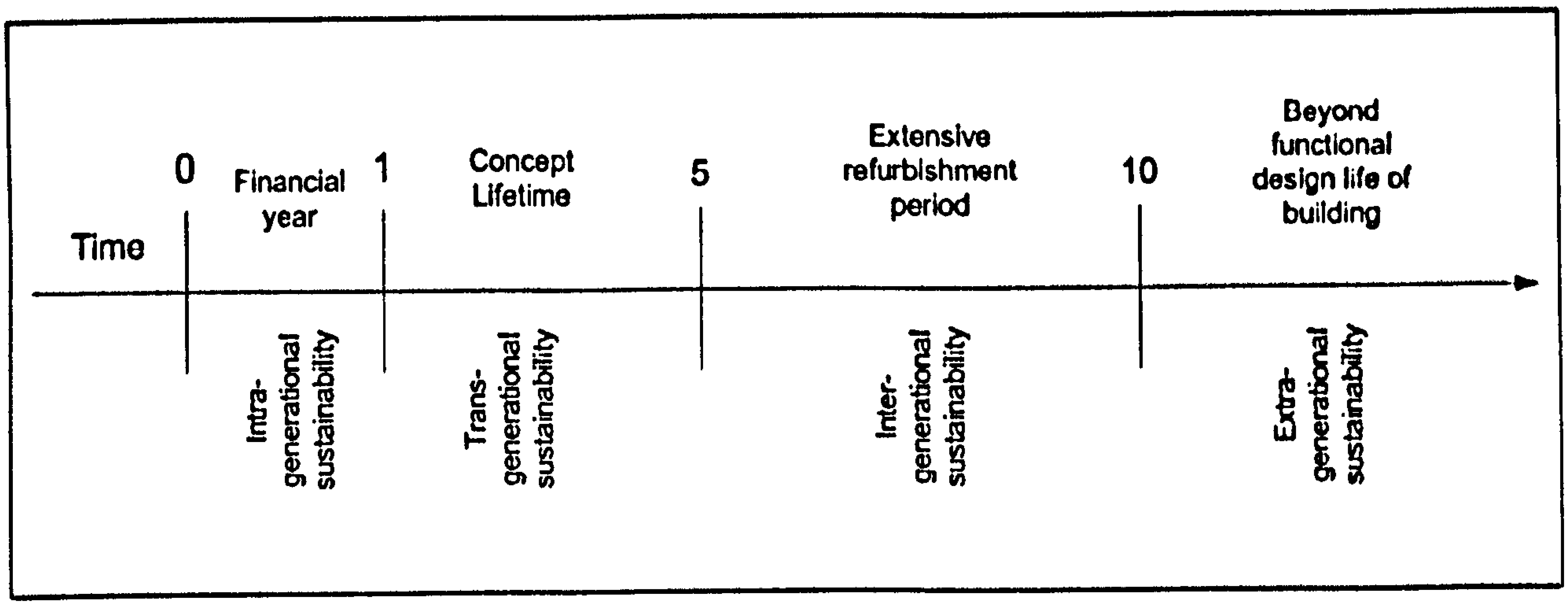


Figure 3-20 Futurity in Retail Architecture

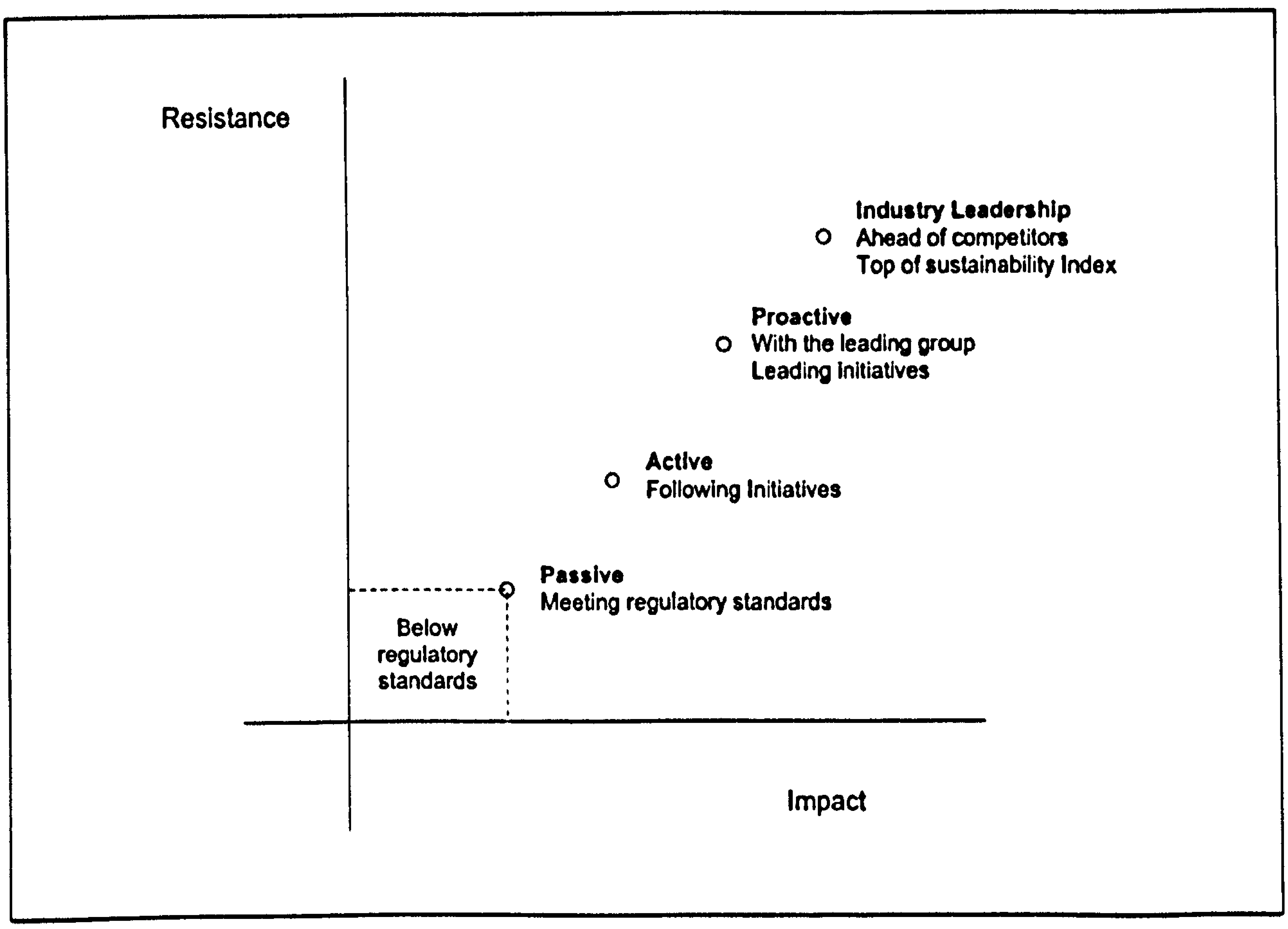


Figure 3-21 Profundity in Retail Architecture

3.4.1 Implications for the design methodology framework

The findings of this chapter would suggest that sustainability is an increasing trend in retail architecture, however only representative of a small proportion of the overall retail landscape of the UK. The design methodology framework must address a number of issues. The differences between large shell developments, fit-out tenancies and concessions must be accommodated; difference in programme length and opportunities for analysis, breadth of scale and procurement method. It must also acknowledge and integrate the complexity of Landlord and tenant responsibilities towards meeting legislation, planning requirements and agreed sustainability strategies. The requirements for monitoring of retail buildings for the retailer's Corporate Social Responsibility reporting mechanism (whether independent or through a body such as BiTC) must be incorporated. The design methodology framework must also appeal to retailers who place economic issues (profit) as a priority and draw them towards addressing social and environmental issues as a result of addressing economic sustainability. The design methodology framework must also address to continuity between the concept design, the implementation and the facilities management and manage the changes of design intent, fabric or technology which occur throughout the route from feasibility scheme to feedback and monitoring.

3.5 Conclusion

This chapter has set out to establish the nature and context for the retail industry and retail architecture and how criteria for sustainability established in chapter 2 can be addressed in retail architecture. This has been pursued through the historical and geographical context of the UK retail industry, which has demonstrated that the range in scale between the smallest and largest retail schemes is vast and that there is a significant nesting of responsibilities between these two scales.

Theories and concepts in retailing are based closely around marketing theories and the need to sell goods to make money. This establishes that economic sustainability has been the primary motive in design and that this may be a difficult pattern to change. The change in social responsibility has become apparent in many retail facilities, but environmental responsibility is less well documented. Many barriers to more sustainable retail architecture exist, but opportunities have also been identified. Some of these opportunities are to be found in management and communication others in the defining of performance indicators and criteria to allow better design. The criteria for sustainability established in chapter 2 can be applied to retail architecture with minor modifications.

This chapter has relied heavily on literature review and pre-knowledge of practical experience of one architectural practice, which though recent, may not be sufficiently current or replicable in this fast moving field. Investigations to obtain data bout current practices will be the subject of Chapter 5 current practices. Before a design methodology framework can be developed, it is necessary to consider the pre-existing environmental evaluation and analysis methods available and how they could be applied to the problem of analysis in the retail sector. The next chapter will seek to establish how environmental assessment methodology and applied tools can address the need for both a common approach and to support the criteria for sustainability.

4 Environmental Assessment

Environmental analysis has been long established in the fields of planning and engineering. These techniques have not however been readily transferred into the mass of the construction industry and only used in specialist circumstances. We must ask why that is and how available methods that could be better or differently applied to address the problem of sustainability in retail architecture. The aim of this chapter is to explore existing environmental analysis methodologies and establish the potential effectiveness of these methods on retail projects. This process will be carried out through the following objectives;

1. To understand the concepts of environmental and ecological economics and their role in evaluation methodologies.
2. To compare the objective single and multi-criteria and subjective methodologies for environmental evaluation in applied to the built environment.
3. To consider the specific issues relating to the application of these methodologies in retail architecture and how the methods considered might help to address these issues and meet the criteria for sustainability defined in chapter 2.
4. To determine how effectively the selected methods satisfy the criteria for sustainability established in chapter 2 by using the applied methods concluded to be most appropriate for analysis and design decision-making using simulated data,
5. To identify the barriers and opportunities for using the methods explored and how this investigation will inform the development of a design methodology framework.

The first two objectives use a literature review strategy. The third objective will use field experience with literature review to develop logical argumentation. The fourth objective will use simulation tactics to test identified methods. Tactics employed in each investigation will be described in the section.

4.1 Environmental and Ecological Economics

It is important to distinguish between Environmental and Ecological Economics. Environmental economics place positive value on items that have formerly been seen as free or commonly owned such as clean air, or supplies of sea fish and negative value on pollution, noise and other environmental degradation. Ecological Economics seek to modify traditional market behaviours through positive or negative incentives assumed to benefit the environment. Environmental economics have been considered the realm of the economist whereas Ecological Economics are the tools of politicians. This section will consider how these concepts are used and their impact on environmental assessment on the construction industry.

4.1.1 Environmental Economics Methods

Environmental evaluation has been used to give economic value to goods that would otherwise have no unitary value. Two main methods exist; Statistical explicit (distinct/factual) analysis methods and implicit (decisions/opinion) survey data methods. These can be carried out as ex ante (design) and ex post (feedback), these types are further subdivided by monetary and non-monetary evaluation (Nijkamp et al, 1990). Weighting criteria of very differing natures against each other in some means that can be readily compared has resulted in a variety of methods developed to address this problem. However there are a number of drawbacks; subjective and sometimes political manipulation can take place and the application of arbitrary figures can easily result.

Cost Benefit analysis (CBA) is a technique for considering the value of a policy, project or business decision over the long term. Economic cost benefit analysis presents all attributes in monetary value and at net present value by a process of discounting. Costs (flows of expenditure) are set against benefits (flows of revenue). Its popularity lies in the quantitative nature of the analysis that easily reflects improved or reduced value. This investment process analysis is pertinent to many forms of business and does not necessarily have a specific environmental aim. Barde and Pearce (1991) suggest that CBA may help to make polluting actions and their costs clearer to the industries that generate them.

CBA is also used to assess value over time with the inclusion of discounting. Discounting theory supposes that capital productivity is a major factor in decision-making. This impatience on the part of investors to make earliest gains is the greatest barrier against sustainable development in economical terms (Philibert, 1999). By introducing a discounting rate, long-term economics of a given project can be better considered. Discounting theory has a major draw back of needing a realistic rate to be set and consequentially is most suitable for comparison of very similar projects using the same rate to aid selection of the best option.

Though popular for its ease of representation, CBA is theoretical in nature and many environmentalists argue that the assessment of sustainable development cannot be modelled on financial indicators alone. The nature of discounting is such that it relies on the principle time preference, and that is counter to intergenerational equity or sustainability (Turner et al, 1994; Bell and Morse, 1999; Barde and Pearce, 1991; Cato and Kennett, 1991). Traditionally, economists have used historical data to make predictions (Cato and Kennett, 1999) and as such CBA has no potential for accounting for future events that may affect the accuracy of predictions such as war, changes in policy and laws or adverse climatic conditions such as El Nino or potential effects of climate change. As the value is financially based, all resulting data must carry a long-term disclaimer against error to protect the appraising authority. In an attempt to reconcile the conflict between economy and environment, it became increasingly popular in the 1970's to consider environmental problems in terms of economic comparisons, such as cost benefit analysis and environmental impact assessment, in order to attempt to put a higher value on the environment. Whole life costing and other economic valuation methods of measurement have been categorized by many of the commentators advocated here as part of the technocentric methodology. To many designers who are positioned on the Ecocentric and Deterministic methodologies and do not believe that value can be placed on the environment, this may make WLC unappealing or too closely related to the right wing and capitalist notions it has been suggested to represent.

The idea of social cost benefit analysis was advanced by multi criteria analysis or evaluation. Multi criteria analysis uses subjective and objective criteria and often includes elements of CBA. It has been published as a methodology since the 1960's. Langston and Ding (1997) agree that the logical progression of CBA is to include both subjective and objective considerations into a single model. This can be by Net present value, or internal rate of return to demonstrate economic results and some method of sustainability indicator in a point system or other defined ranking. This approach can allow the introduction of much broader indicators of sustainability, such as biodiversity, which are extremely difficult to value economically. As the criteria of MCA can be both diverse and unlimited, it vastly complicates the mathematical approach, making it less attractive for helping to make decisions under time constraints.

Trade-off method	Value criteria in terms of an estimated value. This method is further developed by Contingent Valuation Method
Rating method	Distribute values between criteria based on their relative importance often out of 100%.
Ranking method	Put criteria in order of importance
Verbal statements on weights	Value a statement as between a number of variables (typically five or seven) ranging from high through equal to low
Paired comparisons	Compare pairs of criteria into a matrix to accumulate points into value, which can then be turned into a percentage

Table 4-1 Major survey based methods (Nijkamp et al, 1990)

These methods obviously provide better adjusted weightings when the respondents are taken from an appropriate group with appropriately designed questioning. Clearly, political and media events could highlight certain issues from time to time, giving cause to a change in weightings over time. This effect is particularly relevant in the emotive area of local planning. This type of evaluation becomes difficult to manage if the number of criteria becomes too large, which may lead to the requirement of a hierarchical structure. A combination of these methods may be used, but none have been found to dominate (Nijkamp et al, 1990).

Contingent Valuation Method (CVM) uses the idea of "willingness to pay" (WTP) for a benefit or compensation required to tolerate a loss "willingness to accept" (WTA) in a hypothetical market (Pearce et al, 1989, p69). It is limited by the survey methods used, and can be subject to lack of accuracy. The advantage of this method is its transferability between many types of environmental goods and projects.

A number of further economic methods exist based on survey data and market behaviour. Hedonic price method is used to attempt to value specific assets, for example a view from a property. The values are based on market behaviour to avoid survey-based inaccuracies. Stated Preference method requires the ranking of a variety of options. *Travel Cost Method* assesses the amount of time and money people are prepared to pay to use or visit a site of recreation. *Averting Behaviour Method* considers the cost of environmental quality on human activities. It can be argued that the environment is beyond comparison with economic value and as such, these methods can never be fully representative of the true value of environmental impact. This is a view taken by the traditionally deeply ecocentric environmentalists, however, such avoidance of the issues merely results in a continuation of the status quo.

As many of the methodologies of environmental economics have been developed specifically for planning and land-use management applications, they do not necessarily translate directly into construction applications. Combining CBA and MCA methods has become popular in the field of land-use planning. Bell and Morse (1999) and Barde and Pearce (1991) highlight three problems with using CBA/MCA methods of appraisal. Firstly, the danger taking existing methods such as those described in this chapter to attempt to appraise sustainability without modification to remove their economic bias. Secondly, lack of training in those carrying out the appraisal (also). Thirdly, limits to time and finance available to make decisions using these appraisal techniques. The main contrast between planning and construction is that where planning decision makers are choosing if a proposal should be allowed to develop or not, in construction, it is generally assumed beyond the feasibility stage, which is normally carried out without the involvement of designers, that the proposed development will take place. Designers are rarely the ultimate decision makers; rather they are facilitators to that process. The principles set out by these methodologies cannot be used for design and construction decision making unless the building procurer or decision-making body is leading the process.

4.1.2 Ecological Economic Methods

Ecological economics is a method by which economical constrains placed on businesses and society attempt to control environmental problems through a change in behaviour. These methods are used by governments in capitalist economies in an attempt to limit or control damaging or polluting activities and generate revenue to deal with the effects of those activities. These fall into three broad categories; Market based incentives, Market opportunity and Eco-labelling.

Market based incentives fall into three categories of taxes, charges and fees. Taxes raise revenue, charges attempt to change behaviour, and fees are repayment for a specific government service (Jacobs in Eckersley, 1995).

Taxation and levy of the use of resources such as the UK Climate Change Levy is a typical example of the paradox of ecological economics. There is a political argument that revenue from such taxes should be used to promote better management of these resources, such as more environmentally acceptable methods of energy generation. The taxes will only generate substantial revenue however if, the majority of resource users continue to use the resource. The answer to this unsustainable taxation is to continually reassess the level of taxation. It is also important that the tax is not so high as to stifle the economy. It would be politically dangerous to overtax and as a result, taxes are low enough to have little effect on the user otherwise the costs to industry are merely passed on to consumers thereby raising the market and having no actual effect by suppressing the cost to the resource user. Output tax or product charges and waste disposal charges may also be effective, again if sufficiently high, of varying between products that the consumer appreciates the difference. The Polluter Pays Principle allows the polluter to be responsible for the costs of clearing up environmental damage. Industries have been subject to this principle for some time and budget or insure accordingly. The alternative is to offer businesses tax relief for improved building performance and this is currently being investigated for legislation in 2007 (Miller, 2006).

Incentive schemes such as grants for special environmental features can increase implementation. In a number of EU countries photovoltaic technology has been given government support also allowing building owners to sell surplus electricity back to the grid. European directives are likely to force the industry in the UK to address issues such as energy usage. A great deal has been written on this subject, and its possible effects on economies (Pearce et al, 1989; Turner et al, 1994; Jacobs in Eckersley, 1995). The control of these incentives is outside the realm of the construction industry and is difficult to predict change to these factors in the long term however, it is necessary to be aware of changes to maximise the value of a project.

Encouraging the development of technologies for 'end of pipe' reduction of pollution, waste reduction and recycling or more efficient manufacture and longevity is a difficult area. Green politics views market economies as ultimately unsustainable (Cato and Kennett, 1999). Much of industry sustains itself by the process of built-in obsolescence. The force of competition may help to develop more efficient and environmentally benign products; however, it would appear that regulatory means are more likely to improve this situation. For businesses to market themselves on environmental claims requires that the claims are bona fide and that the consumers care. For industry and business to become more environmentally aware, it may be the employees rather than the customers that have the potential to encourage greener practices (Turner et al, 1994).

Eco-labelling or any kind of labelling of products or services demands the fixing of a standard or gradation by the controlling authority. An example is the letter grading of electrical appliance efficiency, this labelling scheme is however also backed up by a financial explanation in annual running costs to make it more accessible to the public. The failure of eco-labelling is that the purchasers may not be sufficiently aware of the labelling scheme. It is possible to overload the market with such schemes resulting in confusion and ultimately disregard of the standards.

To summarise; Ecological Economics are outside the control of the construction industry and their patrons. However, they are important for evaluating proposals, particularly where they can have a major influence on long-term economic calculations and the decisions that these may influence. This raises the question of whether they should be included in calculations at all as they impossible to predict beyond the next government term and difficult to predict beyond a year, or whether their importance is such that they are crucial to the design process.

4.2 Applied Environmental Analysis Methodology

This section will review environmental evaluation in the construction industry and secondly compare the methods already available and discuss their efficacy. A number of methodologies have been developed to help the construction industry tackle objective analysis (Raftery, 1991). The first generation of these was elemental cost modelling, a mathematical analysis of cost quality and time data that is manually calculated, has increased in complexity as data has been collated by professional bodies. This is essentially the way buildings are priced in the mainstream construction industry. The second generation used regression analysis in the manner of CBA and were assisted by the development of personal computer use in the construction industry. The third generation models have attempted to use artificial intelligence to replicate the decision making process. Raftery (1991) suggests that this final development is one step beyond industry requirements and is just an attempt to theorise the experience, skills and judgment of a profession by academics. However, second generation models have not yet superseded first generation in mainstream use despite the existence of CBA modelling software for 30 years it would appear to be underutilised in preference for elemental cost modelling.

Jacobs in Eckersley (1995) develops a stratification of these methods into six stages of economic approach; traditional methods such as regulations, Primary Neoclassical market values, Secondary neoclassical incentives, tertiary Neoclassical economic evaluation such as CBA, Property rights or *landlordism (authors term)* and an idealised position of Environmental Democracy.

During the 1990's a new industry of Facilities Management ("the study of man's efforts to create wealth through the provision, use and management of facilities" Williams, 2001) has increased the application of evaluation methodologies in the built of environment. The problem of how to prove claims that a certain building or development is considered environmentally benign has been so far tackled in a number of ways. Industry and research bodies in the UK have developed a number of methods for the construction industry; these are grouped by their ultimate method of measurement.

4.2.1 Single Criteria Methods

Single criteria methods use just one criterion to establish value, often this is a financial measure, but other values are used as will be discussed.

1. Define the project
2. Identify the constraints
3. Identify the alternatives (including 'do nothing')
4. Assess the project life and discount rate (typically 5-10% per annum and a lifespan between 25 and 40 years))
5. Identify the costs and benefits (balance sheet)
6. Evaluate the costs and benefits
7. Calculate the net present value
8. Analyse the risk
9. Identify distributional effects and other issues
10. Select the best alternative
11. Present the analysis

Table 4-2 CBA Methodology (for public sector projects) Source: Langston and Ding (2001)

Cost Benefit Analysis (CBA) for building projects has been used in the public sector with the particular aim of selecting from a range of options (Table 4-2). When applied to a construction project, this technique is considered primarily from the view of the investor or user of the resulting building. The purpose of the building is frequently more critical to the analysis than the minutiae of the construction, be that in revenue from rent or the business value of the work carried out within. This significance is such because the building will typically be in use or deriving revenue for some number of years, against the construction cost, salaries, equipment and in-use costs could be considerably greater. The significance is increased as the intended life span of the building increases.

The major flaw of this method is the theoretical debate surrounding discounting as an accurate way of forecasting costs and benefits. It also fails to recognize any cost or benefit that cannot easily be monetorised, therefore environmental and social costs are difficult to equate without the incorporation of a Contingent Valuation (CVM) exercise. This method of ranking projects by Net Present Value removes the use of intuitive selection and can become too complex to allow public participation in selection. Ashworth (1994) argues that CBA is most useful in the public sector as these organisations do not need to show profit. However when CBA is based on purely economic information, it is perhaps more well suited to development in the private sector than the public realm. However, as it can be applied in many project types and has clear assumptions it allows projects to be assessed on their economical CBA in an easily ranked way. The significant use of this method is selecting one project over another on the merits of monetary value.

Life Cycle Costing (LCC) is the economic assessment of an item, system or facility over a projected time period to compare design alternatives for financial cost effectiveness or for use in asset management. The basic concept of whole life costing involves making a ratio of capital expenditure over revenue expenditure for a building project. This extends from initial construction, through operation, maintenance, periodic replacement and alterations and ultimately to demolition. This form of analysis has been used in the US since the 1930's but increasingly since the energy crisis of 1974 (Kirk and Dell'Isola, 1995) for the inclusion of energy running costs. In its purest form, the presentation of results is as a financial sum of money that has been discounted for a design life period and therefore is similar to cost benefit analysis. LCC techniques are useful as a design tool in choosing between competing options and as a management tool for estimating future running costs and budgeting future maintenance expenditure. It is important to note that there is no pre-determined method or industry standard for this kind of analysis, and no benchmarking value system yet exists. LCC has more recently become known as Whole Life Costing

(WLC), this may help to differentiate between life cycle costing and analysis (Ferry et al, 1999) and is the preferred term here.

The most simplified measure of WLC is the payback period. This measurement estimates the time in which a benefit pays for itself in reduced expenditure or increased revenue. Flanagan et al (1989) suggest that the payback is too ambiguous and does not reflect the time value of money therefore it should be discounted. Payback period analysis does remain in popular use however as the mathematics are straightforward. Ecological economics have a significant role in affecting how taxation, grants and price increases in fuel can make very significant difference to pay back period calculations. Ashworth (1994) notes that planned maintenance work is not need led but budget led, therefore WLC has a role to play in forecasting and budgeting for maintenance before the need arises. If the need is ignored, maintenance costs can rise significantly, for example in replacing roof materials. Public works departments may be able to plan and budget for maintenance in this way, however commercial building managers may be under pressure to demonstrate profit and delay maintenance until the next financial year. In practice maintenance planning is structured around annual repairs and maintenance surveys required by insurers, and reactive maintenance agreements.

A number of assumptions about a project must be made in order to gain useful results such as the expected design life of the subject of analysis and the relevant period of analysis for the building type, user activity and future discounted value of the building as an asset (Ashworth, 1994). Other known values such as site, construction costs and fees can be established and refined as a design is developed. These figures can be supplied to a numerical model, which gives a result of cap-ex / re-vex. A higher ratio value represents a more successful building, either by being very cheap to run, or by making considerable revenue in rent or sales. Studies by Flanagan et al (1989) and Kirk and Dell'Isola (1995) have demonstrated that the higher the discount rate used, the less weight is attached to future costs or the lower the discount rate, the greater the apparent running costs. It may be sensible to take an average of historical interest rates over the period of analysis to get a realistic rate. A figure between 1% and 5% is typically used however, due to the dependence on discounting, risk or sensitivity analysis is also considered. An example would be setting out results as calculated using two extreme values and a middle value, allowing stakeholders to see that the results are subject to inflation and not a certainty.

The main criticisms of WLC methodology are difficulties in equating capital expenditure and revenue expenditure and difficulties in forecasting the future in terms of inflation and ecological economics. It could be argued that WLC is of uncertain value without the supplementation of physical, performance and quality data (Flanagan et al, 1989). Needing to be addressed alongside other methodologies such as design quality indicators and post occupancy evaluation (Hurst, 2006). It might have been expected that WLC should be useful in profit making projects where financial information is critical, however it would appear that is the relationship with time that is more important in WLC than basic CBA favoured by commercial developers. As has been noted in chapter 3 WLC is more accurate over shorter life cycles (which would appear more applicable to the developer than long term government investment in hospitals or school). This paradoxical relationship is perhaps highlighted by industry research demonstrating that WLC in PFI bids is largely being carried out in an unscientific manner (David Bartholomew Associates, 2002). A Whole Life Costing method has been developed by the Whole Life Cost Forum (2006), a group of industry based companies set up in 2000 with BRE backing to develop an on-line comparative design tool for the selection of construction materials and methods for best cost-benefit in relation to maintenance and renewal rates. This method differs from traditional WLC in that is assumes that the project is not being compared with other projects, but that options for components or systems within the project as a whole are being compared. Kishk and Pollock (2004) have developed a best value selection model based on WLC primarily for use in the health services where long term management of building stock is a major financial burden.

Whole life costing and other economic valuation methods of measurement have been categorized by many of the commentators advocated here as part of the technocentric methodology. Others are dismissive due to current crudeness of modelling techniques (Hagan, 2001). Other Environmental evaluation techniques such as Life Cycle

Costing and benchmarking or weightings calculation have remained limited in use. Ideally, all theses concepts should be used in building design.

Other economic life cycle related methods include Probabilistic Life Cycle Costing (Kirkham at al, 2004) using failure data for specific building components. The programme is intended to develop a logbook, including a database of performance expectancy and costs and deterioration models though probabilistic analysis. This method is particularly pertinent in long term managed facilities such as hospitals and housing stock. Its basis is data on building component failure rates in varying levels of exposure and use categories to establish wear and tear by users as well as weathering and material life expectancy. Building Pathology compares the life of a building to that of a human has become common analogy in WLC. Taking this medical approach to diagnosis of problems in existing buildings, and treating them to regular performance checks (Raven, 2003) is counter balanced by attempts to model deterioration (Nurden, 2002). The value of using these methods in design are not well documented, however, it is easy for the procurement team to imagine how structures and materials can deteriorate through experience of existing buildings.

4.2.2 Resource Savings and Carbon Footprints

The idea of Zero Energy and low energy buildings has been investigated with various levels of success since the energy crises of the 1970's. Defining buildings by the amount of energy used per m^2 or per occupant is a useful way of comparing similar building types. Energy use has been significant in government policy and the building user can see running cost savings in avoidance of climate change levy and take up of financial incentives to use PV or combined heat and power, especially where excess electricity can be sold back to the national grid. In the UK, such incentives are much lower than in Japan or Germany (Leggett, 2002; Littlefield, 2002).

One method of carrying out such analysis is in *Carbon Footprinting*. The sum of all the carbon accountable to a business would need to include many increments including transport costs for staff and saleable product, shares of infrastructure and services and food and transport costs incurred by customers. In analysis of a building the sum is confined to carbon resulting from the design and construction process including transport of site workers, embodied energy in the production of materials, energy used on site, and design carbon output in use. This can be checked against actual in-use figures in the first year, but is of course subject to any business and management changes implemented during that time. It can be seen that it could be quite difficult to rigorously control the embodied energy in materials used by subcontractors, or site staff travel. For this reason it is unlikely that any calculation could be anything more than an educated assumption. It is easier to demonstrate a reduction in carbon output by a specific initiative, such as improved thermal efficiency and air-tightness, introduction of micro-generation, or as a less rigorously verifiable method of trade-off against planting of trees, investment in low carbon technology in developing countries or purchase of electricity from a renewable source. The methodology is based on measurement, reduction, off-setting and reporting which can be managed by a third party. Savings made by subcontractors and suppliers of construction projects can be accumulated for the end user business to choose to support verified off-setting projects that meet their own CSR aims (planet-positive, 2007; dcarbon8, 2007 provide examples of rigorous and third party verification services).

The resource saving method includes all utilities costs (electricity, gas, heating oil etc and metered water) per metre of floor space and kWh per metre of floor space. Reintroduction of energy as a differentiator by the introduction of AD Part L (2006) may force other important issues such as waste and materials resources out of the main focus of design and construction of retail facilities. Whilst useful to compare buildings, this method does not associate energy costs with overall costs or CBA and WLC to prevent the effect of other overheads diminishing the cost of energy. This method however must differentiate between running cost energy (heating and lighting) and energy used in the processes and activities within the building (computers and communications etc) that relate the efficiency of the users not the building. Energy use and carbon dioxide pollution is only one aspect of environmental impact of buildings and it is therefore not a reliable benchmark of sustainability on its own. One way of tackling this inequality is to calculate CO_2 saved by a particular energy saving or generating element can be offset by the cost of it, as £ spent/CO_2

saved. This naturally shows that good insulation standards and well-designed plant are more effective expenditure that PV or wind turbines, which have more perceived value for their visual message.

Energy use modelling programmes however have an important place in helping to predict running costs and improve building envelope arrangement and performance during design stages. One such is three dimensional modelling software <Virtual Environment> developed by the University of Strathclyde's Architecture and Building Aids Computer Unit (ABACUS) now managed by IES (Pacey, 2003). Particularly useful in that it can import CAD models from AutoCAD drawing formats and measures solar gain and heat losses through construction and orientation and is accepted for Part L2 assessment.

The Producer Responsibility Obligations (Packaging Waste) Regulations 2005 came into force 1 January 2006 changing the obligations that companies face when it comes to packaging waste. This legislation requires that more packaging waste will be recycled and recovered and that there will be more businesses involved in such operations. Waste modelling programmes exist to allow prediction of site waste quantities arising from differing projects and help towards reducing such waste, examples of such are SmartWaste (BRE, 2007c) and WasteCost (NGS, 2007). These are essentially tools for the contractor, but can help to reduce waste in design if they are brought into the design development process.

Reducing water use is in the interests of many business to save money and drought conditions in the South East of the UK in 2006 has increased interest in reducing water consumption. The easiest method to calculate water use is the calculation of user profiles, but this is not straight forward in buildings with fluctuating use levels. Calculating a percentage of reduction is the most recognised method of analysis, but this requires an accurate baseline from an existing building, or previous years meter readings before improvements are made. Those that use water in processes are subject to regulations on pollution. Rainwater management is more straightforward to calculate volumes from climate data and provide attenuation or containment. The single criteria methods discussed above have a strong economic element either in the calculation of actual cost, cost over time and financial risk. Energy use and carbon is a very complex issue, both linked to in-use costs due to oil, coal and gas production costs and political issues. Whilst these costs can be used to help generate CBA and WLC these are unpredictable in the extreme and not a reliable way to plan for energy use over the life of a building. Carbon dioxide is a more reliable means to quantify energy use as the unit of measurement is not financial. This method can provide a series of performance indicators that can be used to compare individual shops and retail businesses and can be seen to appeal to the commercial interest in saving running costs.

4.2.3 Multi-Criteria Methods

A number of published methods have been developed for evaluating buildings using Multi Criteria Analysis (MCA) methods. Weighted Evaluation Matrices allow a variety of criteria to be valued against each other (as in *paired comparisons*) to develop an overall weighting of each criteria. This weighting is then used to value alternatives with a numerical score. One example is demonstrated by Flanagan et al (1989). Evaluation of environmental impact of materials is carried out in this way by the BRE (2007a) to give specific materials and products a grade of A-C, with A being the best environmental profile. The Ecopoints environmental life cycle analysis method has been developed into a rating based method by the BRE (Llewellyn and Edwards, 1998; BRE, 2003). Normalised scores, based on the calculated environmental impact of one person per year, for 12 environmental impact categories (Table 4-3) have been weighted by a public paired comparison exercise. Although the methodology of this analysis is multi-criteria, the overall measurement is of environmental impact of specific materials. This allows designers the option to select the better product from a range of suppliers on environmental grounds alongside those of cost. It is however a straightforward representation to help specifiers make decisions with very differing criteria.

The Ecopoints method of evaluation requires a committee or survey approach to prepare realistic weightings, and a wide ranging and large number of stakeholders to complete the exercise for it to be rigorous. The normalisation methodology could be argued to be less transparent in comparison to providing raw data. This is a particular problem in comparing products from manufacturers which have been certified at the same rating. The number of companies undergoing certification remains low. It is very applicable in retail interiors for substitution of typical materials and products where published for generic examples in Anderson and Shiers (2002). The next revision of the methodology using re-evaluated weightings may prove more useful as it will include a wider range of six equally divided grades and more materials. It can only be hoped that more manufacturers and suppliers will undergo the accreditation procedure in due course, but that is only likely to happen as demand from specifiers is made apparent to the manufacturers.

This method has been further developed by the BRE with ENVEST programmes which model the whole building proposal using ecopoints/m2 and with WLC. This method may be useful in large retail shell development where the time constraints are less demanding and the shell of the building can be developed for best performance. In retail fit-out and concession projects there may be limited potential to make improvements to the performance of the project by this method as treating specific elements may be preferred to modelling the whole building.

Climate change,	Eutrophication,
Acid deposition,	Fossil fuel depletion,
Ozone depletion,	Minerals Extraction,
Photochemical ozone creation,	Water extraction,
Human toxicity,	Waste disposal,
Ecotoxicity,	Transport pollution and congestion

Table 4-3 Impact categories (BRE 2006)

Williams (2001) demonstrates a straightforward method of Zero base analysis comparing two options for both LCC and subjective criteria. One or more options are compared against a base (or typical standard) option to compare how the option improves reduces or does not change criteria such as comfort, perceived quality or ease of cleaning. This can be reproduced with a number of options against the base option to ascertain the best design. This method is suitable where a proposal is already completely designed, but would become difficult to manage during the design process. The primary use of this method is in substantiating design decisions to stakeholders from a wider range of criteria than solely initial cost. It can be seen that there would be some benefit in using this method in retail fit-out projects where standard details had already been agreed by a client with concept designer to substitute better products.

Quality Function Deployment (Sarja, 2002) is a similar method that has been developed in product design industries and uses a matrix to identify product requirements from multiple stakeholders and provide and audit trail for changes. These are split into three groups, characteristics, attributes and design. Similar principles are found in the categories of *functionality*, *build quality* and *impact* in Design Quality Indicators (DQI). A study using these principles (Kamara et al 1999) on buildings found that the process was helpful in clarifying the requirements of the project and potentially reduced cost and difficulties during design development and in construction. The benefits to the building procurer and users in an improved brief are obvious. A study by Gann et al (2003) demonstrates that this is an effective design methodology to capture experience and discussion. This method is allied with other weighting methods and doubtless very useful in large and complex multi-user buildings. The difficulty for retailers is in the surveying of a sufficiently wide customer base, if this method is employed it is more likely to be about product than the retail facility and be carried out by market researchers. This information may be used to help formulate store design, however, it is likely to take a lesser precedent to sales data analysis.

Constructing Excellence, Construction Industry Council, the Department for Trade and Industry and the Commission for the Built Environment have supported the development of a web based weighted matrices calculator Design Quality Indicator DQI. This tool allows a committee of stakeholders to consider a range of questions for which they can choose to agree or disagree. The stakeholders can complete this survey on-line and the results formulate what is effectively a briefing document that can be checked at stages during the project. The questions are spilt into three sections Functionality, Build Quality and Impact, these broadly follow the Vitruvian principles of Commodity, Firmness and delight. These are then ranked in four levels of

Fundamental, Added value, Excellence or *not applicable.* Other emerging tools are Whole Life Value Toolkit by the BRE, developed to work with the Construction Industry Councils Design Quality Indicator, Constructing Excellence's KPI and Benchmarking and Loughborough University's VALiD to provide a framework to assist stakeholders in finding the optimum balance between whole life costs, time and quality. These methods have a very useful role in developing criteria in projects where there are diverse and numerous stakeholders, such and schools, hospitals and projects where there is a large committee planning the project or a project with an innovative brief.

Williams (2001) has developed a form of Facilities Management Benchmarking through Multi-Criteria Analysis that has been distributed through the consulting practice Bernard Williams Associates. This method uses a ranking out or 100 in a number of categories to give a profile for a construction project. It is particularly useful in comparing projects such as PFI bid selection. Quantitative benchmarks and are commonly displayed as star or spider diagrams. Analysis may also be based on questioning of service users to ascertain performance on a qualitative scale. In principle it is possible to benchmark any criteria if it is sufficiently represented in the presentation. These methods are also useful to compare the same data sets over time or between projects. Methods of weighting are susceptible to manipulation and subjectivity unless sufficient respondents are sought, and whilst useful as briefing tools and in comparing schemes and options, they would not appear to offer a great deal for the retail scenario unless the questioning was tailored as such. Consideration would also needs to be given as to when that questioning might take place; the points at which the concept designer first becomes involved or when the contractors design and build consultants are brought in, or at several times during the process. Performance indicators of this nature are useful tools if the methodology is clear or could be made a uniform methodology by an NGO.

Diagrammatic representation of a multi-criteria analysis can be made by placing scales on radial arms of a circular diagram. Amoeba (also known as star and spider) diagrams are a data presentation method and can be used to express information in a similar way to a histogram or area chart with differing scales for each arm (Bell and

Morse, 1999). The number of arms is not limited however; more criteria make reading and comparing diagrams more difficult. The arms may relate to LCC as well as other criteria of architectural quality, environmental loading, resource use etc (Sanja, 2002). Benchmarking results can be demonstrated in this way (Bringezu, 2002). Significantly, this method places equal value on each of the criteria selected unless they are combined with weighting methodology. Choosing the scale and representing it as divisions of the arms is a potential area for manipulation of this diagrammatic presentation. Ranking on a subjective scale where, for example, 1 represents "poor" and 6 represents "exceptional". Whether it is necessary to give each impact a score could be debated, it may be better to establish a target or indicator that can be assessed independently such as a carbon output limit or stating that the contractor must be affiliated to a considerate contractor scheme as part of the design criteria. Other in-use issues could be tackled in a similar such as stating a target percentage of waste to be recycled each year for a stated number of years.

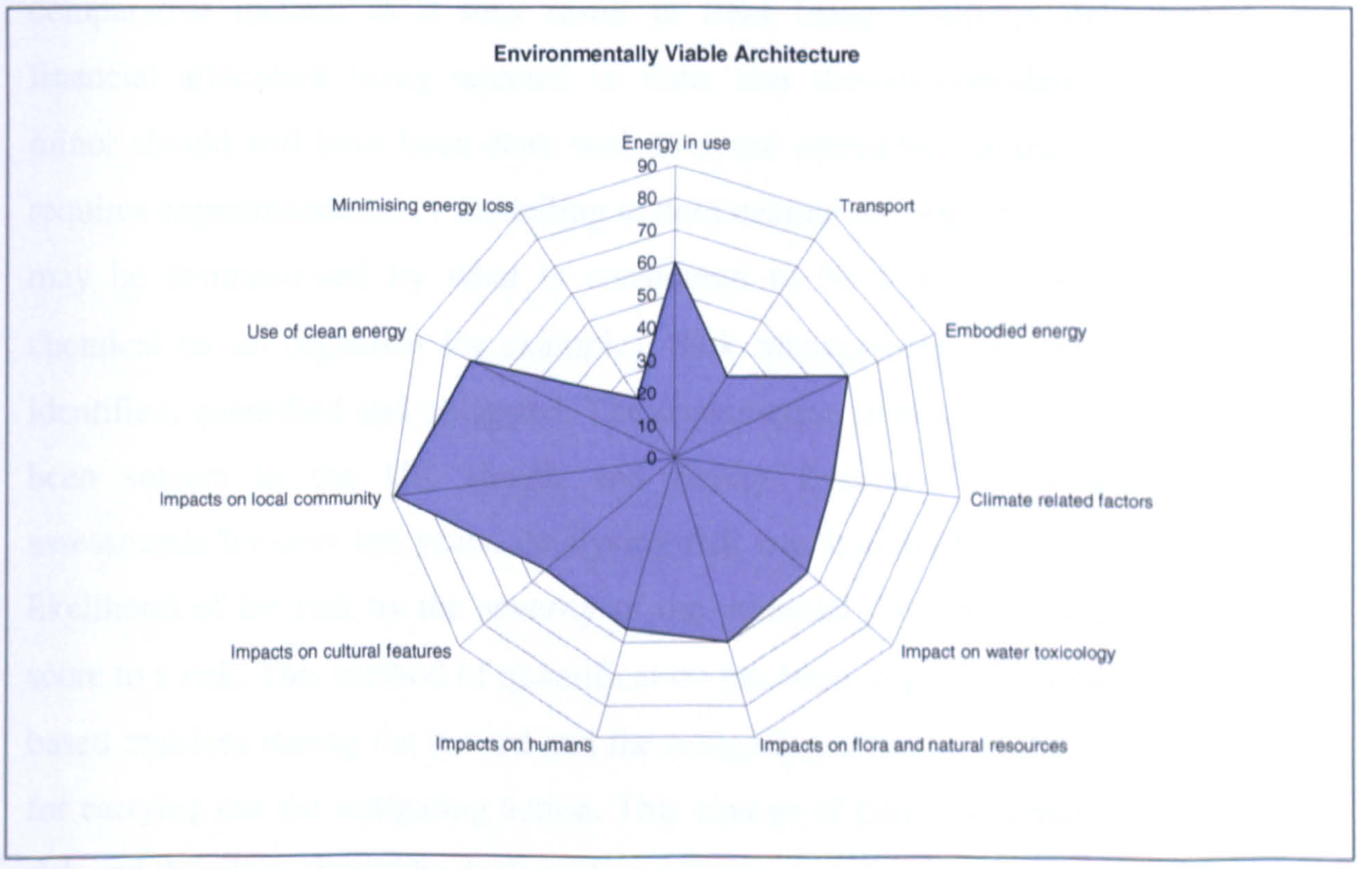


Figure 4-1 Grimshaw Associates' impact diagram (Birch, 2003)

Grimshaw Associates have developed their own software tool, Environmentally viable architecture (EVA) for evaluating the environmental impact of architectural projects at any stage in the design process (Birch, 2003). This format is based on the star/amoeba/radar type popular in business for many benchmarking purposes. The designers of this methodology recognise that the calculation of the percentage scoring via a series of questions will need to be reconsidered periodically to ensure that the weighting criteria are as up to date as possible. This potential fluctuation may mean that long programme design projects may not be able to show continuation or improved environmental status as the design development progresses when issues and technologies cause variation in the scoring result.

4.2.4 Subjective methods

The theory of Risk Assessment and Risk Management have been well established in a wide variety of disciplines. Two methods exist in Risk Assessment (RA), establishing the tipping point at which an action becomes detrimental, this is termed Quantitative RA, the alternative method of Comparative RA ranks the most significant risks in order to allow appropriate allocation of resources and is therefore important in decision making processes. Hester et al (1998) note that there is risk inherent in the comparative method as it may result in risks being inappropriately ranked, and financial allocation being rejected to risks that though considered comparatively minor should still have been dealt with to avoid detriment. Quantitave RA however requires experimentation or modelling to demonstrate the tipping point (in science this may be demonstrated by what is considered to be a lethal dose of a particular chemical on an organism for example). Risk management requires that the risk is identified, quantified and mitigated. The construction industry, like many others have been subject to the UK Health and Safety Executive's requirement for risk assessments for over ten years. Analysing risk was initially based on multiplying the likelihood of the risk by the severity of the potential risk thus giving a high or low score to a risk. This method of quantification has been largely replaced with statement based matrices stating the hazard and the mitigating actions and the responsible party for carrying out the mitigating action. This change of policy assumes that all risk is a risk and therefore should be dealt with and continue to be considered during the life of a building. Calow (1998) holds that the risk discipline is fraught with problems of language and perceptions and that quantification should not be a major focus as it detracts from the complexity of issues and potential for failing to recognise a risk and that it is left unmitigated. Whilst Hester et al (1998) argue for separation of Risk assessment and management. Horick Jones (2001) contends that there is a problem with compartmentalisation of knowledge and experience by division of tasks by professionals.

The purpose of *Ecological Risk Assessment* is defined by Barnthouse (1993, p21) as

> *"... to contribute to the protection and management of the environment through scientifically credible evaluation of the ecological effects of human activities"*

This risk assessment process has been developed into an Environmental Impact Assessment (EIA), and is considered to cover the wider biosphere beyond the primary impact at the site being analysed. Regularly presented in a report format method of stating the impact of a project and mitigation measures developed to meet the Town and Country Planning (Environmental Impact Assessment) Regulations 1999. The Sustainability Statement (SS) is the corresponding design document demonstrating how the design team will mitigate the issued raised by the EIA and boarder issues relating to social and economic impact, reports for which may also be commissioned from specialist consultants. This can be seen as a separation of the RA and RM process which is carried out be separate professionals. The content of such reports are based on the views and opinions of the planning authority concerned, who may publish their own guidelines in response to national planning guidance documentation, and the developer submitting the proposal. Independent and specialist may also be sought by developers to write the report based on intricate knowledge of the local council and their political and ethical views. It is easy to make the report biased towards such aims or regional preferences and to conceal significant issues. Anecdotal evidence might suggest that many claims are unfounded or over stated to win an approval, and the document is discarded once the project commences unless the planning authority condition certain elements. The planning authority may also require a "Design Statement" regarding the aesthetic appearance of the proposals, and these may be bound together into a comprehensive proposal document or brochure. The requirement of these documents is discretionary based on whether there is potential for significant visual and environmental impact. Planners may be influenced by personal factors and the political and personal opinions of the planning committee of the geographical council. Research by Wood and Becker (2005) suggests that environmental impacts such as ecology, noise and traffic emissions are given higher status than socio-economic impacts in determining applications. The publication of these documents broadens the consultation process and promotes better mitigation of the impacts of a development. However, the criteria developed must become conditional to the application to ensure that the developer is bound to carry out the initiatives stated.

The promotional value of making environmental measures is arguably most important in commercial situations. This can be criticised as "Greenwash" and can be characterised by use of very visible but ineffective renewable micro generation schemes, green roofs, or overstated claims in the media (Knutt, 2006). Commercial developers make basic financial calculations on the cost of including sustainable initiatives against not gaining planning consent. In the retail world, public opinion can have a large on sales as the survey commissioned by Co-op has demonstrated. It could be assumed that these effects and values must be considered as secondary to quantifiable entities such as LCC, WLC carbon saving, but that they may be the issues most likely to tip the balance in the decision making process. Calculation of business risk of not being seen to be taking a responsible attitude, particularly in comparison to competitors is perhaps also a less well-recorded mechanism.

These forms of analysis are less likely to be documented in the design process whether occurring without conscious intent or as part of a team design process. Design Charettes (Groat & Wang, 2003) are a formalised process of introducing a wide range of consultants and stakeholders into the design process to obtain innovative responses to specific issues that would normally result in compromise or resorting to traditional design. This is carried out in the format of a meeting or workshop event where the scheme is presented to a wide audience with discussion and alternative ideas being proposed for discussion. It could be seen that this approach is very useful in buildings with public use or occupancy, but it may be limited in the retail and commercial sector as the building procurer might wish to keep significant control over commercial advantage. This does not however preclude the inclusion of representatives from facilities management, contractors, visual merchandise teams, employee groups or store managers, disability groups in meetings with the procurement team. This approach aims to improve a design at earlier stages. The Consultation Matrix approach has arisen from the involvement of a wide variety of design consultants and demonstrates the externalisation of the design process through documentation of options for various technologies, materials and construction methods as options in the building design to be circulated around the consultant team.

Building Research Establishment Environmental Assessment Model (BREEAM) developed by the BRE is used for the analysis of housing, industrial, offices and retail facilities (primarily supermarkets). A bespoke alternative also exists to allow the application of the assessment method to any building type. There would not seem to be many cases of this being used in smaller retail or fit-out projects. The process is carried out by an accredited assessor with the involvement of the design team to set targets for a number of criteria. The sections and points for the retail (BREEAM, 2006) assessment are shown in Table 4-4. Indicative ratings are given as a pass at 33-52%, good 48-62%, very good is 58-72%, and excellent is greater than 70%. Whilst the methodology and assessment system are very useful in many situations, the cost of the assessment is prohibitive in small retail projects, this does not however prevent the procurement team from using the criteria as design guidance.

Section	Credits available	Total Section credits
Management (M)	1. Commissioning (2) 2. Considerate constructors (2) 3. Construction site Impacts (4) 4. Environmental responsibility (1) 5. Tenant engagement (1) 6. Building user guide (1) 7. Building user education (1) 8. Public information dissemination (1) 9. Customer information and interface (1) 10. Environmental policy (1) 11. Environmental purchasing policy (1) 12. Environmental management system (2)	18
Health & Wellbeing (HW)	1. Daylighting (2) 2. High frequency lighting (1) 3. Internal and external lighting levels (1) 4. Internal air pollution (1) 5. Indoor air quality (1) 6. Ventilation rates (1) 7. Smoking policy (1) 8. Thermal comfort (1) 9. Microbial contamination (1) 10. Office space (2) 11. Safer parking (1)	13
Energy (E)	Reduction of CO_2 Emissions (15) 1. Sub-metering of substantial energy uses (1) 2. Sub-metering of areas/tenancy (1) 3. External lighting (1)	47

	4. Building fabric performance and avoidance of air infiltration (2) 5. Maintenance schedules (4) 6. Building services whole life performance (4) 7. Cold food storage (4) 8. Cold food storage walk in cold stores (4) 9. Catering areas (2) 10. Laundry equipment (2) 11. Dry cleaning equipment (2) 12. Lifts (1) 13. Escalators & travelling walkways (1) 14. Energy management (3)	
Transport (T)	1. Provision of public transport (4) 2. Cyclist facilities (2) 3. Pedestrian and cyclist safety (2) 4. Travel security (2) 5. Travel plan (1) 6. Travel information space (2) 7. Local quality partnerships (2) 8. Remote purchase of goods and services (1)	16
Water (W)	1. Water consumption (3) 2. Water meter (1) 3. Major leak detection (1) 4. Sanitary supply shut-off (1) 5. Water recycling (2) 6. Irrigation systems (1) 7. Water recirculation vehicle wash (2) 8. Maintenance of sanitary fittings and controls (1) 9. Water consumption monitoring (2)	14
Materials & Waste	1. Materials specification – major building elements (4) 2. Hard landscaping and boundary protection (1) 3. Low impact paints and varnishes (1) 4. Re-use of building façade (1) 5. Re-use of building structure (1) 6. Recycled aggregates (1) 7. Responsible sourcing of materials (3) 8. Designing for robustness (1) 9. Storage of retailer recyclable waste (1) 10. Storage of household recyclable waste(1) 11. Compactor/bailer (1) 12. Composting (1) 13. Waste minimisation (1)	18
Land use and ecology (LE)	1. Reuse of land (1) 2. Contaminated land (1) 3. Ecological value of site and protection of ecological features (1) 4. Mitigating ecological impact (2) 5. Enhancing site ecology (3) 6. Long term impact on biodiversity (2)	10
Pollution (P)	1. Refrigerant GWP – building services (1) 2. Preventing refrigerant leaks (2) 3. Refrigerant GWP - cold storage (1) 4. Insulant ODP & GWP (1) 5. Insulant ODP & GWP – cold storage (1) 6. NOx emissions from heating source (3) 7. Flood risk (3) 8. Minimising watercourse pollution (1) 9. Pollution prevention (1) 10. Renewable and low emission energy (3) 11. Reduction of night time light pollution (1) 12. Noise attenuation (1) 13. Kitchen wastewater filtration (1)	20
Total credits available		156

Table 4-4 BREEAM Credit breakdown (BRE, 2006)

The National Green Specification (NGS) is an independent organisation. It is partnered with the National Building Specification and Barbour Index to produce an Internet-based resource for all building designers, constructors and manufacturers involved with 'Sustainable Construction' providing National Building Specification compatible work sections and clauses and building product information. The website allows comparison for a wide range of materials based on various criteria but uses positive and negative listing rather than a methodological analysis. The site covers more materials that the *Ecopoints* accreditation system and uses wider criteria than Anderson and Shiers (2002) but lacks rigour as it is based on more subjective opinion.

4.2.5 Integrated Methods

It can be seen that objective analysis tends towards the economic aspects of institutional benchmarking such as CO_2 emissions and subjective towards the environmental aspects that have no institutional value other than in demonstrating Corporate Social Responsibility in sustainability. Both have an important place in demonstrating sustainability but are problematic in juxtaposition. Attempting to use both qualitative and quantitative information to evaluate a project has been developed in a number of ways. Integrated Life Cycle Design (Sarja, 2002) draws on four aspects of lifecycle quality; Financial costs, Ecology, Culture and Human Conditions. This method attempts to formulate economic life cycle costing, social cost benefit analysis, building performance and environmental assessment based on meeting and exceeding set targets (by government or other bodies) in a multi-form, multi-criteria analysis. The method splits social constraints in Human Conditions and Cultural into distinct areas. Not surprisingly, this method is complex and difficult to express results for comparison.

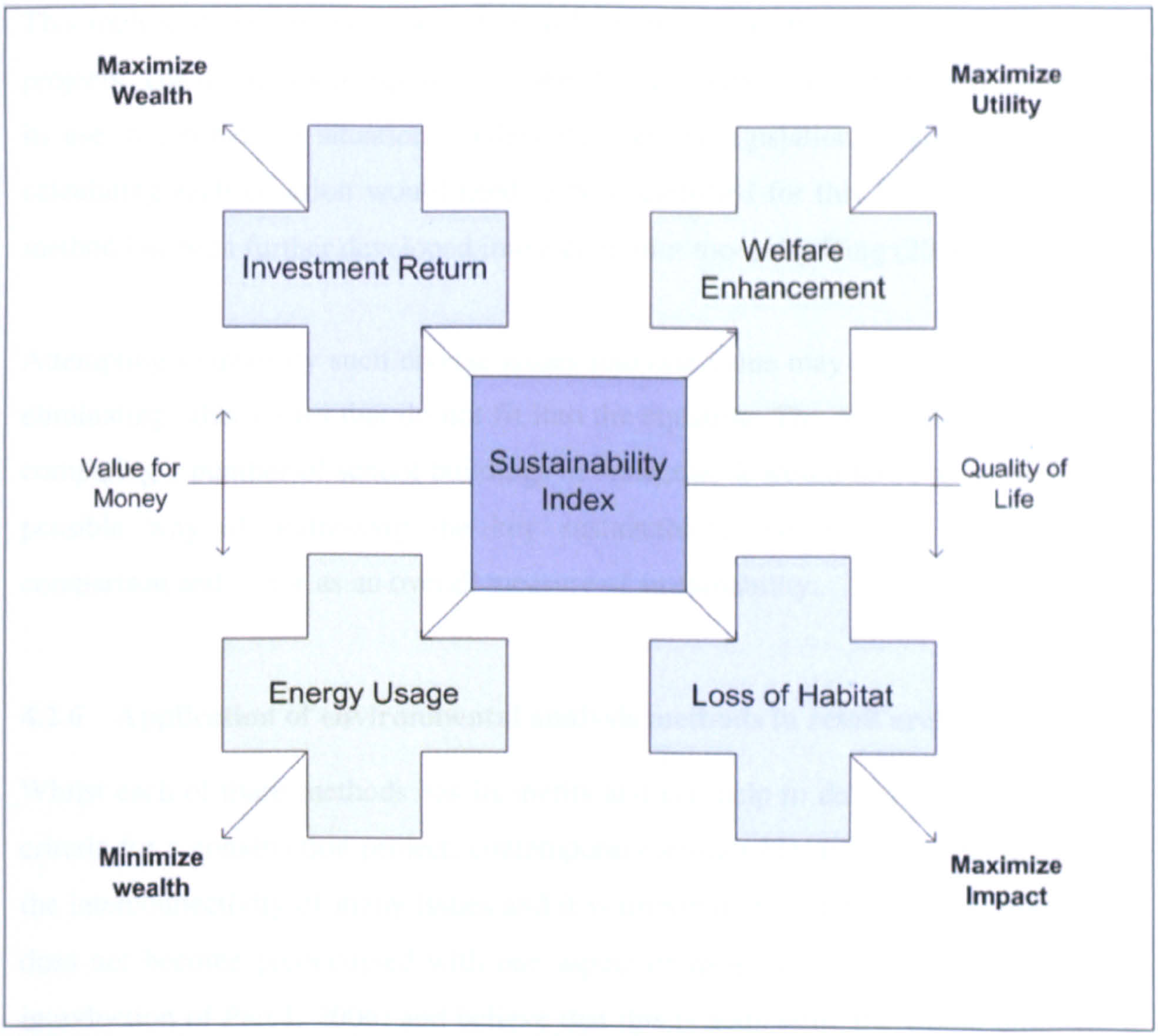


Figure 4-2 Sustainability Index, Langston and Ding (2001)

Langston and Ding (2001) have developed a Sustainability Index valuation system shown in Figure 4-2, that algebraically evaluates four values of Investment return (£cost benefit), welfare enhancement (Social benefit evaluated as a weighted score), energy usage (per m2) and Environmental damage or loss of habitat (% risk) shown in Equation 1 Sustainability Index Formula (Langston and Ding, 2001).

$$\frac{\text{Investment return x welfare enhancement}}{\text{Energy usage x Environmental damage or loss of habitat}}$$

Equation 1 Sustainability Index Formula (Langston and Ding, 2001)

This multi-criteria approach has potential for comparison of design options or similar projects. The information required to make this calculation may limit the possibility of its use in commercial situations (unless required by legislation). Agreed methods of calculating each criterion would need to be established for this to be possible. This method has been further developed into a computer model by Ding (2004).

Attempting to quantify such diverse issues into one value may have its drawbacks in eliminating other issues that do not fit into the equation. The research was limited to comparing a number of school buildings in Australia. It would however seem to be a possible way of addressing the key sustainability indicators at a rate/m^2 for comparison and to use as an overall measure of sustainability.

4.2.6 Application of environmental analysis methods in retail architecture

Whilst each of these methods has its merits and can help to define a range of design criteria for a construction project, contemporary sustainable design is concerned with the interconnectivity of many issues and it is important that the construction industry does not become preoccupied with one aspect or measure (such as energy with the introduction of Part L 2006) and believe that this is addressing the whole problem. It is apparent that existing methods do not independently address all the issues. The idea of replacing cost with value as a more responsible single measure has appeal for retail applications, but this undermines an understanding of social and environmental value as well and economic. Both carbon accounting and the performance target approach are useful to the retailer in CSR reporting because they can be represented as beneficial to wider society and the environment where as financial accounting is difficult to represent as anything other that self interest. This section discuss the potential use of environmental assessment methods in retail architecture

Responding to economic issues may be useful in the retail environment, but there is a requirement of businesses to demonstrate a wider responsibility to their customers. Envest II may help to show a trade-off between economic and environmental factors, but this can be shown by demonstrating CO_2 reduction against capital cost, or CO_2 produced against revenue or profit. Social issues can be demonstrated in a written format and derived from formal impact assessment or marketing data. Whilst the comprehensive approach of Sarja (2002) would seem to be the way forward for balancing the needs of economic, social and environmental sustainability, the SINDEX method proposed by Ding (2004) would seem more user-friendly and easier to demonstrate to a retailer, but final factor of sustainability derived would be meaningless without comparable data for many retail facilities.

Energy use has been re-addressed by Part L of the building regulations, bringing it back into focus as a major sustainability issue. This is being further heightened by the realisation that carbon emissions from buildings remain high despite gradual improvement of thermal efficiency in new buildings, to thermal efficiency home improvements grants and schemes and climate change levy, and increases in UK energy costs well above inflation during 2005-2006. The new methodology is based on the principle of calculating a base building model with 2002 thermal standards and standard plant against improved thermal efficiency, improved plant and trade off against renewable energy micro generation. The improved building should be 20% better in the initial stages of the regulations, but it has been developed in such a way that the improvement ratio can be successively increased. It is expected that these regulations will have a major impact on speculative retail development, and fit-out tenant works that have previously been constructed with little, if any, regard to carbon emissions. A report by CRISP (David Bartholomew Associates 2002) suggests that efficiency standards are often not achieved in practice, mainly due to the site conditions, supervision and poor workmanship.

The resource saving method is particularly useful to the retail building user as it renders definable targets on a resource that has an identifiable cost at the present time and offer long term savings regardless of what happens to energy pricing. There is also a potential to increase the percentage of improvement as a target year on year or over roll-out programme of store development. Perhaps what would be most useful here is a database of comparable record data calculated by a standard methodology for a variety of retail types to facilitate the process of improved performance and ranking of retailers.

The need for an external assessor required for BREEAM assessment is not ideal for the retail scenario as the cost and time involved would only be acceptable for larger stores. Although the superstores assessment is available and bespoke assessments can be devised, it is not readily taken up in retail architecture. The social impact of a retail development is difficult to address as unlike a school or hospital, the uses have much higher levels of choice, especially in the comparison sector. Retail shell development is able to demonstrate report based analysis and is subject to planning conditions that attempt to address social costs and benefits. The surveying of stakeholders in their wide variety might be possible however this is already sufficiently considered in retail impact assessment and that the service provided can only exist if there is sufficient demand and quality is ensured through competition. Development managers are then able to choose a tenant mix based on quality of retail offer, presentation of shop fronts etc thus ensuring quality and variety. The social impact of the retail unit within a development is more dependent on the quality of the retail experience of the customer and their selective custom henceforth. The social impact of the experience of the employee is more critical, but as discussed in chapter 3, quality staff can only be maintained by the retailer offering a good employment package and environment and that this level of quality has a direct impact on custom and hence profits. It is therefore assumed that the retailer's HR and CSR policy and local community involvement is active and sufficiently disseminated.

Weighted matrices for design quality as in DQI and similar assessments require the establishment of indicators of quality and social impact. To a certain extent these are catered for by standards and legislations such as planning guidance notes and Disability Discrimination Act 2004. What sets one store apart from another is dependent on image and branding as well as physical attributes of the facility. Specific questions would need to be developed for each retailer and surveying be carried out. This would require considerable effort on the part of the retailer to establish their customer base and implementing a survey. They could then aim to please the bulk of their customer base. It would be difficult for a customer to imagine a hypothetical store unless they can compare it against a store they know already. Example quality indicators for retail architecture are shown in Table 4-5 Design Quality Indicators for retail.

Example Customer criteria	Example Staff criteria
Access and provision of facilities for the disabled	Availability of daylight
Provision of facilities for babies and small children	Physical comfort (temperature, noise)
Navigability (signage quality)	WC and changing facilities
Colour rendering of lighting	Breakout area/staff room facilities
General level of cleanliness and repair	Access for disabled staff members
Spaciousness	Access to car/bicycle parking
Style and design	Access to public transport
	Personal Security within store
	Personal security on arrival and departure
	Waste minimisation and separation facilities
	Circulation off sales floor
	Communications within store

Table 4-5 Design Quality Indicators for retail

The value of this exercise is limited by the assumption that some of these things will occur through statutory requirements or be provided by the landlord and others are desired but unlikely to be achievable (such as daylight in a store placed deep within a mall). It may be more advantages to use this information as a briefing checklist. Feedback comments on previous stores drawn out through interview or a workshop session may be more enlightening and valuable. It could be argued that many customers don't think about these matters unless prompted to do so, or have a heightened sensitivity to particular issues (new parents and the recently disabled are prime examples). It is also apparent that market research can provide the retailer with this information that is then applied to their design brief.

Feedback Questions that could be asked of existing staff in existing stores to make weighted matrices for employees on a rating of very poor to excellent. These would not include CSR/HR matters that do not directly relate to the built fabric such as policy on local community involvement schemes or paternity leave. These could also be ranked by respondents to provide weighting for a hypothetical store. It would be very difficult to survey potential staff members for a new store as they are rarely appointed until 4-6 weeks before stores open and the construction phase is almost complete.

Some of the packages discussed here have taken considerable time to prepare and the investors provide a "Black-box" or web based computation or independent assessment for a fee. Such methods of analysis allow the user to work on-line or download a package that accepts a number of variables to be calculated by the software to give a result. Other methods involve a consultation or facilitation process, and hence incur a fee. This commercially biased way in which some of theses methodologies have been developed highlights two problems, firstly how the sustainability and cost relationship is expressed and compared and secondly an element of protectionism of the method as a saleable product.

It would appear that in order to provide the best level of evaluation of a project in this manner, a new set of criteria must be devised for each project that reflects the user requirements fully. Whilst this has been carried out conventionally as the briefing process, to truly do justice to the analysis of the brief is task beyond the resources of many building procurers, and the experience of most designers. It is also clear that the financial incentives of ecological economics issues and environmental issues are not fixed in time and hence the weightings used in mixed criteria analysis change through time and location and as new legislation and technological developments are made. It is clear that without a comprehensive cataloguing of retail specific industry data on building performance these methods can only be used to make comparisons between options or alternative proposals.

The next section will take the methods discussed above that can be applied to the retail situation for use with historical and hypothetical data in analysis. Whole life costing because this represents a method of balancing capital construction costs against maintenance costs and hence improved economic sustainability for the retail business whilst helping to tackle resource use and waste management. This methodology can demonstrate economic and environmental performance and is essentially a *Technocentric* approach. Resource savings accounting to establish the importance of the relationship between costs of electrical and mechanical plant installations in retail projects and the carbon dioxide that these are accountable for, and how better design can reduce the environmental impact of a retail facility. This is a again a Technocentric approach but can be used to demonstrate environmental and economic sustainability. Comparative analysis of specific materials because this represents a method of managing the environmental impact of the materials specified whilst also dealing with the issue of embodied energy. This is an ecocentric approach, and will demonstrate environmental performance. BREEAM Assessment as this offers analysis for the meeting of environmental and social needs and has an established place in the planning process, it also includes use of the methodologies of WLC, resource savings assessments, social and environmental impact assessment and requires many similar features to CSR reporting. This has a broad approach and can demonstrate environmental and social performance. Finally, Multi criteria analysis using Sarja and Ding as a basis to combine economic, social and environmental impacts into one measure which could allow ranking of retailers businesses as a market driven incentive for improvement.

4.3 Environmental Assessment Simulation

4.3.1 Aims, objectives and anticipated outcomes

This investigation aimed to demonstrate how effective the existing tools would be for retail architecture, the objectives were;

1. To test if the tools could be used for retail projects
2. To establish opportunities and barriers to their use.
3. To establish how the tools met the criteria for sustainability identified in chapter 2
4. To determine how this would inform the development of a design methodology framework.

It was anticipated that the tools would work to some extent in the retail situation, but would not independently answer the criteria fully.

4.3.2 Research tactics

This strategy accepts that retail architecture cannot provide a context suitable for experimental research and instead uses a *simulation* tactic to test theory (Groat and Wang, 2002) against criteria identified by logical argumentation. The environmental assessment methods were tested using hypothetical data or scenarios for four differing retail forms; a small high quality fit-out tenant, a mid-sized low quality fit-out tenant, a large department store tenant, and a retail shell development. These forms were selected to demonstrate a wide range of construction cost, programme length, design life and specifications and are based on experience of building procurement for a variety of retailers. These hypothetical clients might also have very different expectations and these assumptions are stated in Table 4-6. The projects are assumed to be being assessed in 2006 and to Building Control Part L2006 requirements for air-tightness and energy use.

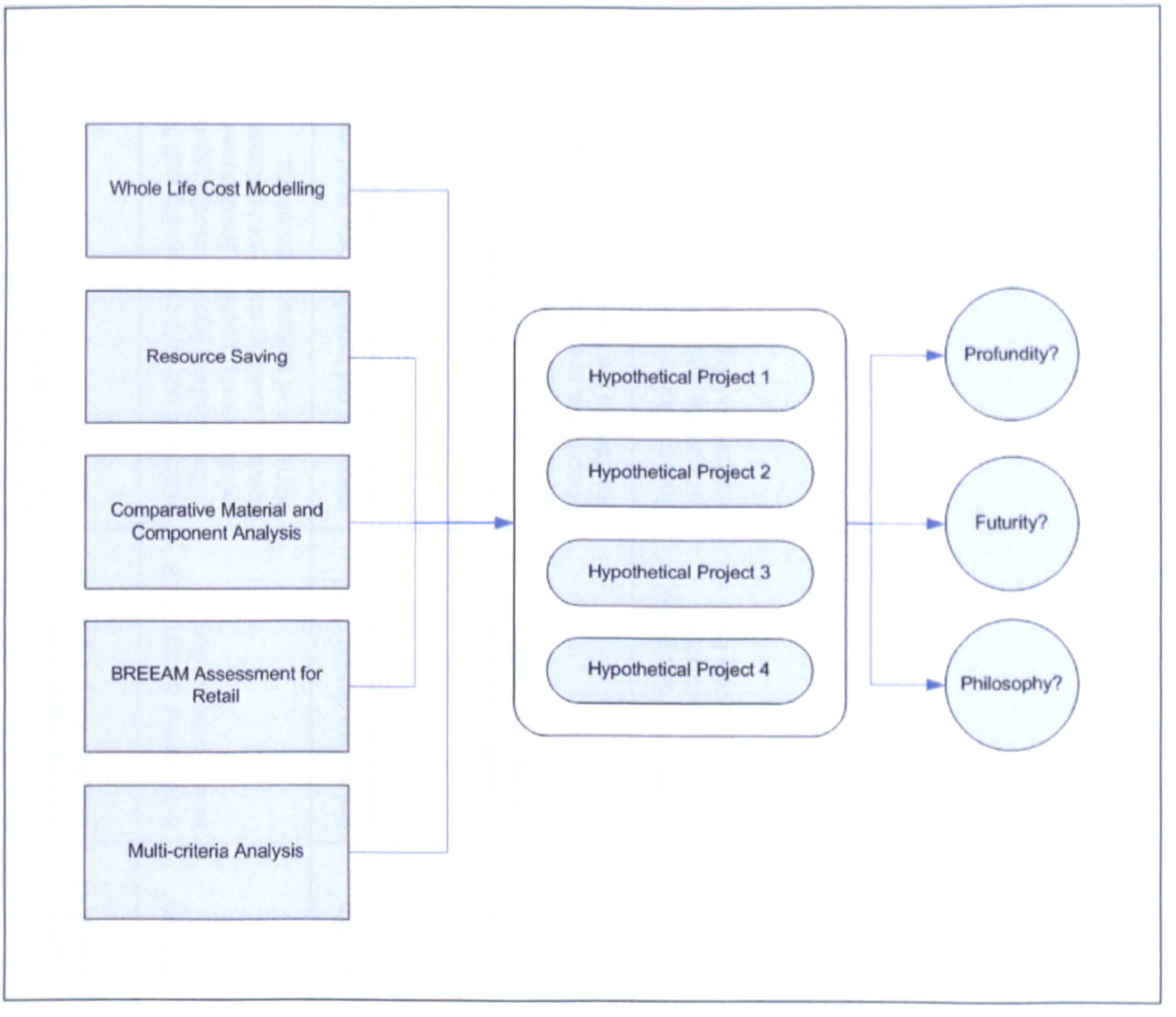


Figure 4-3 Testing existing methodologies by simulation

Retail form	Typical tenant	Typical location	Typical Gross floor area	Typical cost £/m^2	Typical design and construction programme	Typical construction
Small high quality fashion retailer	Quality and branded clothing; Gant, Monsoon, Jigsaw, Coast etc	High street (Strip-out completed by previous tenant)	180m^2 on two floors	£900m^2	8-10 weeks design, 8-12 weeks construction	Interior fit out only comprising wall floor and ceiling finishes, lighting, modifications to existing heating cooling small power and data services, existing shop front retained with new signage and exterior decorations.
Mid sized low quality fashion retailer	Clothes and shoes; Sports World, JJB, Primark, Next, New Look etc.	Retail terrace (new shell with block work faced walls	2000m^2 on one floor	£400m^2	3-4 weeks design, 8-12 weeks construction	Interior fit out including new steel mezzanine sales areas, welfare facilities for staff, storage areas New shop front with roller shutter doors, new signage
Department store	Major retailer with concessions; House of Fraser, John Lewis, Debenhams, Marks and Spencer etc	Anchor tenant in new shell constructed by a developer as part of a larger retail setting in a town centre.	12,000m^2 on three floors	£700m^2	40 weeks design 40 weeks construction	Interior fit out with all M&E services with extensive staff welfare facilities, storage racking system, lifts, escalators, and signage. Shop fronts and other areas of glazing provided in the shell building.
Retail shell development	Two large department stores, 3 mid-sized fashion retailers, 8 small fashion retailers (also 3 hot food operations and one pub)	New shell constructed by a developer as part of a larger retail setting in a town centre.	Up to 100,000m2. Some parts multi story.	£1000m^2	1-3 years in design 1-2 years in construction (including works by tenants)	Construction of shell including all landscaping, car parking road junctions and infrastructure required to integrate with townscape.

Table 4-6 Simulation retail project data

4.3.3 Whole Life Cost Modelling

With a design life of five years or less and a tendency for staff to carry out basic cleaning and maintenance tasks within their job description, only major damage and product failure could be considered to calculate expenditure in use and these might be more likely to be caused by accident and be insurable risks. In this situation, any WLC modelling is unlikely to be beneficial in demonstrating anything other than capital expenditure. More relevant are the ease of cleaning and general wear and tear characteristics of specified materials as they would not reach the end of their effective life before they are removed. What would be helpful is a planning strategy to allow materials to be reintegrated in the following design scheme, or to design for maximum flexibility with demountable display fixtures and moveable partitions that can have new surface treatment to update brand image. These design strategies may be counter productive in the look and feel intended in a re-branding exercise especially at the high end, as they are very often employed at the low end and portray an image of cheapness. There may be some difficulty obtaining realistic costs for reclaim or second hand value on products, materials and equipment although in reality this would be a useful factor in the economics of the refitting process.

Again the design life of these projects at five to ten years may not allow many of the constituent parts of the interior to reach the end of their effective life. Floorings and ceilings would receive a good deal of wear in that time and un-protected painted surfaces may be re-painted more than once within that in that period. Cleaning may be by a contract company, and this cost could be included in a model for specific items. Demountable fixturing is likely to be employed in this case and with additions can make layout changes without disruptions to floor or ceiling finishes.

With a design life of 10-20 years, it is more likely that items such as floor finishes would be replaced because they are worn out, although layout arrangements being reviewed within that period may require re-location and replacement of finishes. It is also likely that ceiling tiles might be replaced within that time span. Using elemental comparison for such items with a calculation programme can provide very useful information in design decision making with regard to specific supplier data.

Whole life costing for a retail development is a very valid exercise which helps to develop a maintenance profile and management plan for the development. It would be likely that the investor would require a minimum period before any major replacements of shell materials would be carried out, and this might be as much as 20 or 30 years. Again, this would be an exercise carried out by comparing actual product data and relevant manufacture guarantees for a specific element such as roof flashings, windows and cladding.

One of the issues that is significant in WLC for retail buildings is that of tax-deductible refurbishments. However, the UK taxation system causes this area to be very complicated, with three forms of taxation treatment on expenditure. Repairs are tax- deductible, but improvements are not. Inevitably, refurbishment will include both repair and improvement. Further to this problem is that capital expenditure is defined as providing enduring benefit to the business by the courts. However, many retail interiors are refurbished at between two and ten year intervals, and naturally it is difficult to just repair a shopfit when market conditions are pressing for significant upgrades and image changes, fortunately these can often be viewed as repair. The exact distinctions on each project are decided by the tax inspector. Plant items can attract capital allowances, but only if they are necessary for a particular form of business and not necessary for any interior of a building. A example is the security equipment used in a shop is considered to be plant, but lighting is not. However in the case of Wimpy International Ltd v Warland, special lighting in the counter area was held to be plant as it's purpose was to colour the food to make it more appetising (Garrod, 2002). The categories have been made successively more defined in the last decade and as result fewer items are considered to be plant. However, since April 2001, energy saving equipment is considered to be plant if it meets certain criteria.

4.3.4 Resource Saving

The primary resources of building materials, electricity, gas and water and the secondary waste through construction and in-use can be used to demonstrate savings throughout the retail facility. The principle of resource saving requires a baseline building to be ascertained, either by calculation based on a building that exists or a hypothetical building using baseline regulations, such as the use of a notional building built under Part L (2002) in the case of Part L (2006). Most retailers have an advantage here because they can easily access record data for existing stores in a variety of environments to create a baseline for fit-out stores previously unaffected by Part L .

Obtaining a base energy use profile for existing stores would allow savings potentials to be demonstrated. It would be anticipated that this would be carried out by implementing a low energy lighting scheme, and resulting savings in cooling load and greater use of ventilation. It would be very difficult for a retailer to reduce security and data uses. Attention would need to be given to the protocol for having doors stood open and use of a hot air curtain. The availability of LED lighting for interior schemes has improved rapidly, in 2005-2006 (Entwistle, March 2006). Particularly suitable for retail applications is the replacement 3 LED lamp and Solar six channel lamp (MR16-6) for halogen spot MR16, these can be substituted in the existing fittings and are widely available, with increasingly competitive prices. These lamps also offer a colour temperature of 3000k by mixing amber and white diodes, which is ideal for fabrics. Taking the example of a typical shop window with 20 lamps on a track system, the lamps would all need to be replaced together to avoid visible colour and brightness variations. Based on 10 hours per day for seven days a week that the shop window would be illuminated, the following savings are possible. Water use may be limited to one WC and a staff tea making area and is not significant. Obtaining rainwater is possible very complicated where different tenancies exist above, and where the building is historic.

The mid sized low cost fashion retailer is likely to use significant amounts of electricity on lighting and cooling, which could be reduced by design. There is a tendency for this retail form to have open shop fronts even on the high street which is likely to result in seasonal losses and gains and a high load heating and cooling load addressing that loss. Water use may be fairly low, with provision for staff welfare only and occasionally a customer café and toilets. In this situation it is difficult to demonstrate large savings, but this might be possible with selection of water saving fittings and staff management policy.

The large department store will have considerable energy needs and probably require a dedicated sub-station. Savings again could be made in lighting design and associated reduction in heat gain would reduce cooling loads. Draught lobbies are more common on large stores and these help to balance seasonal losses and gains. Opportunities may exist for micro generation on large roof areas, although these may be limited by overshadowing and turbulence. Water use may be significant with restaurants and customer toilets as well as staff welfare facilities including showers. Rainwater storage for flushing could be very useful here as roof areas can be large.

The developer is required to consider how the shell will allow the tenants to reduce their energy requirements as the actual energy use of the shell is fairly low, relating mostly to external lighting and security systems. This can be managed in a number of ways; offering a private wire network utilising micro-generation, or district heating with combined heat and power, offering a greater access to natural daylight within stores and avoiding very deep plans, offering a ventilation or heat recovery system such as night time cooling, or simply stating limits as part of the requirements of the tenants.

This method is both Ecocentric in addressing carbon emissions and water usage, and Technocentric in the application of engineering to effect those reductions. Consideration of profundity to set targets is evident, but futurity is only addressed if there is a facilities management plan to ensure the targets are met and managed over time.

4.3.5 Comparative Material and Component Analysis

This method allows elemental comparisons of a wide range of materials however the greatest difficulty for the specifier is in choosing between two similar examples of a material such a carpet tile made by two differing manufactures using the same fibres, with very similar embodied energy, but slightly differing in other respects such as colour price and weight. The designer would in this instance require very detailed information to justify the selection and this would be need to be obtained directly from the manufacturer. Both might have an "A" rating based on weighted comparison by Ecopoints Method (Anderson and Sheirs) but there would be some differentiator that would cause the decision to be made, the clients performance requirements would have to prevail in this instance (colour, wear and slip resistance, delivery and cost which the client would need to rank in importance). This would result in the client's team reverting to the intuitive method, using the analysis as a guide only.

Location	Conventional Specification	Retailers key criteria	Generic Ecopoints (Anderson and Shiers, 2002)	National Green Specification (NGS, 2005) Recommendation
Flooring	Marmoleum	Low Cost, seamless finish, regular replacement cycle accepted	A rating	First choice
	Ceramic tiles	Durability, quality appearance	A rating	Second choice
	Printed PVC	High quality finish, many alternatives, medium cost	B rating	Products with Polyolefin preferred Explore recycling potential with supplier
Wall Paint	Matt vinyl emulsion	General	C rating	Do not specify
	Matt acrylic emulsion	Reduced maintenance in high traffic areas	A rating	Zero VOC acrylic emulsion
	Ecopaint	Reduced VOC's	A rating	Linseed oil based paint with natural pigments
Ceiling	Plasterboard on timber battens	Limited ceiling void required	A rating	No guidance
	Plaster board on metal fixings	Void required for services	A rating	No guidance
	Gypsum Ceiling tile in aluminium grid	Access to services and flexibility for light fittings	A rating	No guidance

Table 7 Guidance in specification of materials

The retail cases are likely to have a very similar range of materials, but the design criteria for each might be different. For example, the high cost fashion retailer is likely to place a higher value on concept and visual appearance than the low cost retailer, and be prepared to manage cleaning in different ways, making the choices that are appropriate to each retailer fairly narrow.

Generic specifications have become institutionalised throughout the design construction industry and they allow substitution to be made by the contractor for a potentially cheaper and possibly inferior product than that which might have been originally specified. Historically, substitution has been a relatively minor concern but with the rise in the importance of sustainability, the substitution of a non-sustainable for a sustainable building product should not now be an option. A dedicated specification is a specification that is written for a particular product. By including within the specification criteria unique to that product, a contractor is left with considerably less scope to substitute a product which fails to be 'or equivalent'. This may be a more relevant method for the retail development project where substitution for value engineering is likely.

Both routes to material selection could effectively address profundity, but are a very ecocentric approach and would only address futurity if used in conjunction with maintenance and whole life costing data.

4.3.6 BREEAM Assessment for Retail

A pre-assessment checklist has been used to estimate how the projects might score if a full assessment was carried out. In a full assessment, those criteria that could not be applied can be eliminated and the scoring carried out pro rata. This process has been used to ensure that the rankings are as fair as possible for the four simulation studies, however, this is a subjective method of analysis and the scoring can only be indicative.

For the high quality retailer simulation, there is no possibility of effect on local ecology and this section is omitted entirely. A number of cold storage criteria are not relevant, nor are those for parking and external lighting. The matters relating to the shell are not controlled by the tenant in this case, these would affect the external shell specification, space for waste storage and car or cycle parking, but are beneficial in that there is no implications for external drainage or external light pollution. The typical store might be expected to achieve a low *very good* rating, achieving an excellent would require significant design and management input. The opportunities to do this are to improve the energy management, transport planning and pollution management areas as these are the low scoring sections. The low cast retailer simulation excluded the same criteria as for the high quality fashion simulation. The major area for improvement is in energy efficiency, but the performance could be radically improved with some additional capital expenditure and client management. In a typical department store achieving a high *very good* rating, this simulation demonstrates that it would in fact be very easy to achieve an *excellent* rating for a department store with some preparation for assessment in the design stages. However, this raises the question of how easy it is to achieve the highest rating, and is this should now be reviewed the BRE. The assessment of the retail development eliminated all of criteria relating tenant fit out works and as a result achieved a very high *excellent* rating. Again this raises questions as to the validity of the rating breakdown as it would be possible to achieve almost 100% without much effort and certainly not a considerable capital outlay.

	Small Quality fashion fit out	Mid-sized low cost fashion	Large department store	Retail shell development
Management	11/18	8/18	15/16	18/18
Health & Wellbeing	8/10	5/10	11/13	1/1
Energy	9/27	4/27	18/39	10/10
Transport	6/16	2/16	12/16	15/16
Water	8/11	5/11	7/11	1/4
Materials & Waste	13/14	6/14	13/16	14/21
Local Ecology	0/0	0/0	0/0	6/10
Pollution	11/16	8/112	13/19	7/12
Total credits achieved/credits available	66/112	38/112	89/130	72/92
Percentage	58.9%	33.9%	68.5%	78%
Indicative rating	Very Good	Pass	Very Good	Excellent

Table 4-8 BREEAM Assessment Simulation

This assessment method has been rigorously developed by the BRE to allow assessment on a national benchmarked level, which provides a good tool for comparability and an industry standard. It also supports the integration of the client's CR policy into the design. However it does not meet the criteria set out in chapter 2 for the following reasons; Although there is a good assessor training programme, it is still possible to interpret the crediting system differently, allowing for possible disparity and attaining a higher rating by a narrow margin. The valuation of the crediting system is insufficiently graduated to allow stratification that would demonstrate active, proactive and leadership levels of *profundity*. A score of 100% is technically feasible, which does not support the process of continual improvement.

The process does not sufficiently address *futurity* by not actively supporting planning for future change and demolition, nor does it reward specific relationships between design life and flexibility, issues that may be very significant in change of use and tenant needs in retail property. The assessment methodology is weighted heavily towards energy reduction (30%), which is beneficial to overall environmental impact, but does not allow enough credits to be gained from good design and detailing of interiors, which is the main area of environmental impact in small stores. The assessment methodology is on the whole technocentrically biased as there is a high dependence on engineering systems and documentation to demonstrate mitigation of risks rather than supporting the client in changing customer behaviour.

4.3.7 Multi criteria Analysis

Using the Sustainability Index Method (SI) (Ding, 2002) in its original form SI is suitable to be used directly on a retail development that involves shell works although this would not be a straight forward exercise. The four values need to be re-equated for use in retail fit-out projects as the social and environmental impacts cannot be calculated in the conventional manner and these assignments are explained below thus;

1. Numerical Cost Benefit (or Client Benefit) which can be discounted at a specified rate or left as a basic annual sum for the number years of the buildings lifetime.

To equate this to a retail situation the profits derived from sales of product are already discounted for overheads including running costs and staff costs and would present the most readily available method of calculation albeit in a the form of a projected sum. The construction cost of the project is directly equitable to other building types. As has already been identified, lifecycles for retail fitout projects can be so short that discounting is virtually irrelevant.

2. Social benefit calculated by weighted evaluation matrices.

Obtaining a weighted calculation for the social benefit of a retail fitout within a larger mall or terrace development would not show the true benefit of the stores existence, as if it did not exist it would be detrimental to the scheme as a whole unless another tenant took the unit. A better measure would be the number of jobs created per metre squared (employment rate) divided by the total number of retail experiences enjoyed (footfall) per metre squared. This can be demonstrated as a beneficial ratio if it is it higher as the ratio of staff to customers must have an optimum number where by staff are occupied enough to not be bored, without being so busy they suffer stress. In a business situation it is unlikely that too many staff would be employed as this would have a negative impact on profits due to high staff costs, likewise, if not enough staff are employed, sales will be affected by customers being unwilling to queue or suffer poor service. The cost of the product is also a factor in this equation as has been discussed in chapter 3, low product cost stores do not offer the level of personal service that a high product cost store does. Again, if calculated in design or construction stages these would be projections.

3. Total energy use per metre squared.

In Dings equation this is in Gj. In order to suit the UK industry, this figure would be more usefully based on annual CO^2 output per m^2 multiplied by the number of years of the lifecycle. This does not include the embodied energy inherent in materials, however, until sufficient published information is available to calculate a one off carbon cost against a bill of quantities, its rigour could not be ensured enough to be worth including. This measure would be the same for both retail fit out and shell development and would be readily available due to impending legislative changes to Part L of the building regulations.

4. Environmental damage risk %

This figure is potentially the most difficult to establish. Ding suggests that an environmental impact /risk analysis study is used. This is appropriate in the shell development scenario, but not for the tenanted unit fit-out project, where the assumption of the existence of a shop is already made. Instead the damage anticipated by the production of non-recycled waste could present an equitable value. The inherent problem with this calculation is that this is a theoretical assumption based on what can be recycled at any point in time and how and where landfill waste is disposed of in tandem with the incentives of levies and taxes at any point in time. Therefore, for a retail fit-out the following equation shown in Equation 2 should provide a retail sustainability index.

$$\text{Sustainability Index} = \frac{TCB \times TSB}{TC \times W}$$

Where;

TCB = profit x years / construction cost

TSB = Employment per m2 / footfall per m2 x years

TC = Annual tonnes C02 output x years

W = Annual tonnes non-recycled waste/m2

Equation 2 Retail sustainability index (RSI)

In order to demonstrate the use of this method the following simulations demonstrate how a retailer might improve their sustainability index. A store can improve their sustainability index by; increasing profits by increasing sales or reducing overheads of maintenance costs; Increasing social benefits – although this has an optimum level; Increasing lifecycle – there is a point at which this starts to impact on profits as overheads in the rate of maintenance costs and also loss of sales to competitors; Reducing $C0_2$ output – this has the biggest potential for an improved RSI; Reducing volume of non recyclable waste

The expression of sustainability as a fraction or a percentage of sustainability suggests finite limits on performance which would be detrimental to continual improvement. Correlation of SI or SR data would help to make these figures seem relevant to consultants and clients, particularly in a roll-out scenario where learning and design improvement could be most easily demonstrated. However, the data set is probably easier to comprehend as a comparison dataset, for example against other similar retailers' stores or within a chain. This may suggest that the criteria are more useful as a statement of performance along side the assumptions for improvement as stated above hat the lifecycle and social benefit should be aimed at increasing over time and the CO_2 output and non-recyclable waste should aim to be reduced.

	Small high quality fashion retailer	Mid sized low cost retailer	Typical department store
Construction cost	£200,000	£1 million	£10 million
Total net area	$150m^2$	$500m^2$	$2500m^2$
Projected annual profit	£100,000	£750,000	£3 million
Lifecycle	5 years	10 years	10 years
Employment rate	10	40	500
Annual footfall	5000	100,000	300,000
Annual CO_2 output	100 $kg/CO_2/m2$	80 $kg/CO_2/m2$	150 $kg/CO_2/m2$
Annual tonnes non recycled waste	10	30	50
Sustainability Index	49.75	78.125	23.28

Table 4-9 Sustainability Index Simulation Conclusions

As demonstrated by the sustainability index calculation modified for the specific situation of retail fit-out projects, a single figure measure is not as useful to the design team as a number of performance indicators. In an ideal situation a number of different targets could be expressed as part of the brief. This would allow the design team to be aware of the overall aim of the project as far as sustainability issues were concerned. All of the methods tested in this chapter capture the proposed project or a feed back stage at one moment in time. The assessment would need to be repeated over time as factors changed and as many are outside the control and possible the data available to the design team (profit for example) this is not an effective way to support the design process.

4.4 Conclusion

The aim of this chapter was to explore existing environmental analysis methodologies and establish the potential effectiveness of these methods on retail projects. The objectives of this chapter have led to the following findings; Ecological economics may have a vital role to play in how clients make decisions, but they are likely to see economic sustainability as a major source of motivation. A variety of objective single and multi-criteria and subjective methodologies exist for environmental evaluation in applied to the built environment, but those that use financial criteria are to be avoided if social and environmental needs are to be addressed.

Application of these methodologies in retail architecture and how the methods considered might help to address these issues and meet the criteria for sustainability defined in chapter 2 has shown that one method can meet all the criteria, and that they should be either used in conjunction or comparison to provide the widest picture of a performance in an individual project. This varied for the size and scope of each project and therefore should promote a tailored response in both the design strategy and the analysis methods used. The framework needs to support not only the definition of targets but how the project design team has made design decisions and compromises in order to achieve them. The methods used in this chapter have potential for improving the aspects of sustainability that they represent but they need to be used together to create a balanced solution. It is important to note that the tools used are only as good as the information put in.

The question remains regarding how this change in approach should be implemented; to what extent does designing by evaluation overtake the tradition of the designers intuition and is this a good thing for architectural development in the future? Discussion of the aesthetics of environmentalism in Chapter 2 has concluded that design and architecture should still have an aesthetic or theoretical basis but be implemented in a sustainable manner, not that environmental design should eliminate architecture.

Criteria for sustainability		Performance Indicators	Application in Retail
Philosophy	Technocentric	Economic Impact analysis	Necessary to retailer, not usually carried out by design team
		WLC	Elemental approach for cost and maintenance comparisons
		CO_2 emissions/revenue	Necessary for comparison with other retailers
	Deterministic	Social Impact analysis	Planning requirements for larger schemes
		Business and staff practices	Design team has limited input
		CR policy	Design team has limited input
		Facilities management	Need to be involved in design
	Ecocentric	Environmental impact analysis	Planning requirements for larger schemes
		Life cycle analysis	Elemental approach for material selection
		CO_2 emissions/m^2	Necessary for comparison with other retailers
		Waste management	Necessary for comparison with other retailers
Futurity	Intra-generational	Financial year plan	Design team have limited input but this information is necessary to understand the retailers long term view
	Trans-generational	CR policy plan (next two – three years)	
	Inter-generational	Long term CR policy (10 years)	
	Extra-generational	Stakeholder values	
Profundity	Passive	Legislative requirements	Design team have a duty to ensure this is met
	Active	Good practice guideline	Retailer must establish business strategy in respect of this to set targets
	Proactive	Best Practice guideline	
	Industry leadership	Exceed best practice	

Table 4-10 Meeting the criteria

The framework must support the continuing aesthetic skill of designers to enable this to be so. What role would ecological economics play? If more taxation on exceeding certain limits were imposed or rebate for achieving certain standards, would this increase the utilization of LCC for example? It is clear that we cannot use ecological economics to plan how the design process and analyses make buildings more sustainable beyond the very short term as these incentives are dependent on political forces and funding from large bodies such as the EU and are not constant. Therefore these can only be seen as temporary benefits at any one time. In general schemes need to demonstrate efforts to continually improve economic environmental and social sustainability through addressing these changes in a project lifecycle long manner, not just at one point in the procurement process. The framework needs to address this problem too.

Competition between stores in an organization and against their rivals is fierce. Using this competitive tendency to demonstrate figures for non-commercial targets such as energy use, waste recycling per square foot of retail space could help. This process can only be lead by the retail client as they must accept any additional cost or time required to meet more demanding requirements and address the influence of both customers and employees in the future direction of retailing practices.

Bartholomew (2002) has identified that the number of separate initiatives hinders the environmental design process, suggesting a more unified approach be developed to help designers. If the imperative for significance in sustainability is to be followed, the construction industry needs a format that addresses these three factors in a multi-criteria methodology without obfuscation. The aim of this chapter is the identification of the best methods of evaluation for the retail situation. As it has been concluded that the wider ranging the evaluation, the more revealing and potentially useful it can be, then multi-form multi-criteria analysis is the best option. Original data should be as directly represented as possible, the working assumptions should be clear, the procedure should be straightforward or easily deduced, graphical representations should be clearly related to the context. These are to be established as principles in the development of the framework. It is also necessary to consider how the design methodology framework is integrated into the design and construction process to limit its rejection through added cost to the retail client, time on the part of consultants or difficulty on all stakeholders, as all these problems will hinder the acceptance of a change in practice.

This chapter has formed a part of the observation and reflection stage of the experiential learning methodology employed in this research. The next chapter will investigate current practices in retail architecture towards an understanding of the needs and values of the retail client and the design teams that they employ. This will further develop the understanding of the context and aid the conceptualisation of the design methodology framework in Chapter 6.

5 Current Practices in Retail Architecture

The aim of this chapter is to explore current practices in retail architecture that cannot be established from the literature review.
The objectives are;

1. To answer the research questions regarding how and if existing environmental evaluation tools are used.
2. To confirm assumptions about the nature of design and construction of retail architecture.
3. To confirm assumptions about key stakeholder values and strategy regarding sustainability.
4. To establish how the retail industry is responding to the challenge of demonstrating sustainability.

These objectives will be explored through a number of strategies that are outlined in the first section and tactics fully described with each investigation.

5.1 Research strategy

The system of enquiry of the research outlined in chapter 1 is a diverse system of enquiry due to the interdisciplinary nature of the subject but is predominantly *naturalistic*. This section of the research is dedicated to investigating the current situation and uses objective tactics within a naturalist system of enquiry, in that the investigations seek to obtain data and support findings in a sequential exploration from a single architectural practice to the UK scale. Whilst aiming to be objective and credible, there must be an acceptance of the situatedness of the author as a practitioner within an architectural practice and the limitations this places on anonymity and perceived motives by the subjects of investigations. The research strategy for the development of a framework uses Action Research to simultaneously provide a route towards change in working practices and a tool to support that change (this strategy will be described in greater detail in chapter six). The overall research design can be seen on Figure 4 in chapter 1. This chapter concentrates on the field data investigations, which collectively use objective tactics that will be described with each investigation.

5.1.1 Data Collection in the Retail Environment

The investigations were designed to utilise available material and to be manageable within the time frame and financial constraints of the research. Retail is a problem area for data collection as retail managers are likely to be reticent about such activity by third parties taking place in their facilities, and suspicious and protective of sharing information with potential competitors. Observational data on sales staff, customer relations (used by Beng in Shields, 1992) encountered difficulties with not becoming involved with the customer relationship. Survey data of customers may be difficult due to retail organisation intervention. Interviews of staff (i.e. store managers) to establish an understanding of the problems they face and their understanding of how improvements can be made is an option, however, it might tend towards complaints rather than objective analysis of the situation. Mall owners are not keen to divulge statistical data on visitor numbers and rarely allow surveys (Shields, 1992). Published data is available on turnover and profits. O'Brien and Harris (1991) suggest that numerical analytical modelling cannot be subtle enough to handle retailing reality as there are too many human factors although these have some historical precedent in studies such as Anderson (1979), and more recently by Giraldo and Napoleon (2002).

Whilst much research concentrates on shopper behaviour, it is the retailer behaviour that is the subject here. The investigations were designed to concentrate on data available from previous experience of retail projects in architectural practice, direct contact with consultants working in the field and that which is published in the public realm. This allows an understanding of an architectural design project and the factors that influence programme, budget, design decisions and content of the completed retail facility, secondly from other consultants working in the retail sector, thirdly from retailers which the author's employer, Simons Design, have direct contact with and finally from published information available on-line.

The research questions that these investigations answer are specifically;

1. Are environmental evaluation tools used in retail projects by construction professionals?
2. How are environmental design decisions made in retail projects by construction professionals and retailers?
3. How does retailers Corporate Social Responsibility policy translate into retail architecture?

By necessity of the findings of each investigation each of these questions fully, there is some overlap and linkage between them in order to confirm assumptions and test findings.

5.1.2 The Context of Situated Research

Simons Design Ltd is an architectural practice of 30 employees established in 1972, which is part of a larger Group of companies including construction, maintenance and development divisions. The Practice in located in Lincoln, but work is carried out throughout the British Isles with an annual turnover of £1.8million. About one third of the work load is retail fit-out projects with Simons Construction as Design and Build contractors or other contractors for a wide variety of department store, supermarket and high street retailers, another third involves speculative and dedicated shell developments for Simons Developments for mixed use, retail distribution and urban regeneration projects. The remaining work-load is made up of consultancy to pharmaceuticals companies and other corporate clients.

5.1.3 Research Quality

There are a number of drawbacks to be aware of in measuring research quality in this naturalistic system of enquiry. This chapter seeks to establish data with neutrality in order to offset the *transformational impulse* (Groat and Wang, 2002) that will be demonstrated in the *Iterative* and *Emanicipatory* development of the design methodology framework in chapter 6. Credibility can only be guaranteed by triangulation of sources, and in some cases this may be difficult to provide as the information is only accessible from a single source. Thick description or narrative is the most informative method of analysis of completed retail design projects, and this is hindered by the difficulty of displaying large quantities of drawings and project documents within the body of the research to demonstrate various points and, and the limitations of minutes of meetings in demonstrating what occurred in discussions (rather than just what was documented). Consistency is difficult to achieve with case studies due to the unique nature of each case, this can only be achieved with a control experiment or simulation (as demonstrated in chapter 4) these too are subjective analyses. Dependability can be supported by a demonstration of anticipated data instability, and wherever possible such instability must be designed out of data collection.

5.1.4 Investigations

Through the development of understanding of the context of the retail industry in chapter 3 raised a number of issues regarding the design and construction of retail facilities and sustainability might be incorporated into retail facilities; Firstly it could be assumed that current practices in the procurement process are hindering more sustainable approaches to retail facilities because the designers, consultants and constructors do not have the time, capacity, resources or the tools to develop more appropriate solutions. Secondly because of a real or perceived barrier, of the validity and acceptability of sustainable design to retailers, the design team are unable to effectively apply knowledge and resources. Thirdly it could be assumed that retailers do not wish to jeopardise profits for well-meaning but under researched and implemented add-on solutions or to radically change facilities management procedures that may be detrimental to profitability, costly in terms of staff time or unacceptable to customers. Business risk is therefore being set against the need for implementing a new action or change. Fourthly, that legislative powers in planning and building control requiring environmental analysis and are gaining strength to force change in practices which will raise the passive approach above what has until recently been seen as proactive. These issues must be investigated to ensure that the development of the design methodology framework will meet the specific needs of retail architecture.

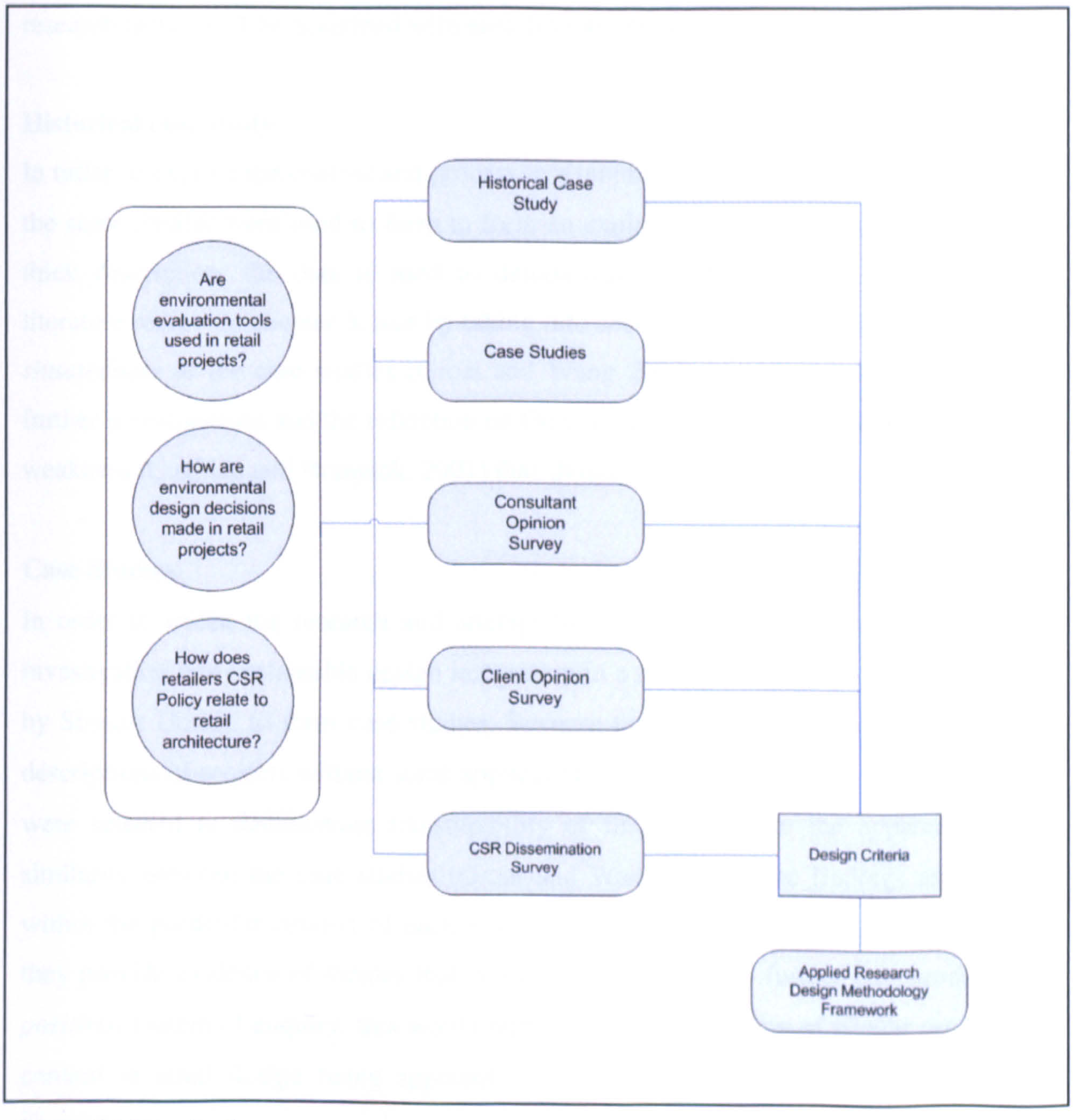


Figure 5-1 Investigations

The research questions that the investigations were design ed to answer are set out in Figure 5-1

1. Are environmental evaluation tools used in retail projects?

2. How are environmental design decisions made in retail projects?
3. How does retailers CSR policy relate to retail architecture?

The following investigations were carried out in a sequential course of data collection, research tactics will be described with each investigation;

Historical case study

In order to explore the content and process in a number of similar projects carried out for the same retailer were used to form to form an exploratory case study (Yin 2003). As a thick description, the data is used to demonstrate credibility of the findings of the literature review in chapter 3, and by taking into account the complexities and *historical situatedness* of the case studies (Groat and Wang 2002) provide a background for the further investigations and the reflection on the practices used could identify strengths and weakness (Coghlan and Brannick, 2001) that should be addressed by the framework.

Case Studies

In order to widen the research and attempt to provide triangulation and credibility an investigation into sustainable design integration in a number of retail projects carried out by Simons Design to form case studies. Because there would be limited value in thick descriptions of projects without some application to the research strategy, the case studies were selected to demonstrate transferability of findings despite the apparent lack of similarity between the case studies (Groat and Wang 2002). The findings are relevant within the particular context of each case and cannot support generalisations, however they provide evidence of themes that could be replicated with further case studies. In a *positivist* system of enquiry, this would represent external validity of similar process and content in retail design being apparent in a variety of contexts within the limits of situatedness.

Consultants' opinion survey

In order to further widen the field of enquiry, an investigation into methods being used to integrate sustainable design in retail design and construction in a wider context in the form of a survey of retail design consultants. This attempts to confirm the findings of the case studies as fundamentally consistent or provide reliability. The survey yielded a very small data set (limited by response rate) and as such could not provide generalisations; instead the data supports the themes developed.

Clients' opinion survey

In order to compare and contrast the consultants' opinion survey, a similar survey was developed to survey retail clients. Again the data set was small (limited by access) preventing generalisations, but supported the dependability of the themes developed in earlier investigations.

Policy document review

An investigation into CSR policy using documents published on-line by a selection of well known retailers in the UK to gauge the profundity, futurity and philosophy employed and establish the quality of information provided generally and specifically about each retailers existing and proposed new stores. An initial search carried out in 2004 found published information fairly limited. The investigation was repeated in 2005 to establish if information had improved and again results were limited. The final investigation was carried out in August 2006. This investigation allowed stable and unobtrusive access to current information made available by each retailer. The weaknesses as described by Yin (2003) are that bias in reporting cannot be eradicated, and the source of evidence is not as stable in the longer term as a literature review.

This chapter will document these investigations and summarise on the findings.

5.2 Investigation 1: Historical Case Study

5.2.1 Aim, objectives and anticipated outcomes

The aim of this investigation was to understand the content and process in the design and procurement of a sequence of small stores for the same retailer in a variety of locations.

These projects are representative of a great deal of quality high street retail facilities in floor area, complexity, range of locations and procurement method. The objectives were

1. To investigate to what extent environmental analysis took place and how this may have informed sequential projects.
2. To understand what factors effected decision making when faced with data pertinent to sustainability.

Key data was based on the information held in project files and drawings and that recorded by the individuals involved in the projects. The anticipated outcome was a demonstration of a gradual improvement in performance indicators relating to sustainability and a greater understanding of the issues involved in the design and decision making process.

5.2.2 Research tactics

Historical data was based on ten projects used to provide data spanning from 2000 to 2005 and represent a roll-out programme for an international high quality men's fashion retailer. The case studies are reported ex-post as a thick description using the project documentation available (drawings, schedules, meeting minutes, and correspondence) but are also supported by ex-post direct observation. Due to limitations of confidentiality, only the floor plans can be supplied in the appendix. The traditional efficacy data is supplied as calculated by the design team. The energy efficiency data is based on electrical billing data provided by the retailer and Energy Savings Trust (2006) calculation methodology.

5.2.3 Description of the historical project data

All of the projects comprise of internal modifications and decorations to an existing shell suitable to install interior finishes and cabinetry to form a store layout suitable for the shape of the unit. The retailer prefers the character of historic and sometimes listed city centre properties in historic and attractive districts as part of an image and brand management policy. They tend to be small and narrow in plan and may have changes in level on the sales floor. The finishes and furniture design concept was provided by an international designer, however, the lighting design was developed with a UK lighting designer although this was not consistently with the same consultants for all projects. This group of projects typically had five elements that made up the major cost of the project; hardwood floor finish, matt white painted plasterboard walls and ceiling, lighting, climate control equipment and cherry wood veneered fixed furniture. The projects are thus very similar; however their individual locations have affected their shop-front requirements and level of external exposure and access to upper floors or basement storage areas. The type of landlord organisation also affected their servicing costs and choice of servicing specification. For example, the air-conditioning may be provided as a mall system or by a localised modified system left by the previous tenant. This aside, they are all expected to provide the same comfort conditions for staff and customers and have a project design life of a minimum of five years. Table 5-1 outlines the typical data for the project which is based on economic efficiency. The projects are described as follows;

1. A new fit-out into the ground floor of a shell development in a large historic building. There was no external entrance, but there were fire escapes and some large display widows to street level.
2. An installation into a previously occupied unit into a large out of town mall with no access to external light and landlord managed cooled supply air. This unit had a very regular plan which conformed to the 1:3 frontage to depth ratio described in Chapter 3.
3. An new fit out in a store already occupied by the client to provide a new concept. This store had considerable basement and upper floor areas used for storage and staff welfare facilities and a very low net to gross ratio of 35%. The store was situated in a high street location in a city centre with a shop front and rear delivery access.
4. A small unit in an outlet centre where the concept was paired down for the lowest net build cost per metre squared. There was no access to external light and the services were provided by the landlord.

5. The largest store, in a unit previously occupied by another retailer in a listed Georgian terrace. Set over a split level and very deep plan with a difficult roof light room and plaster ceiling mouldings.
6. A project carried out for a franchise retailer using the same concept in a new mall. The plan was complicated by a small wedge shaped unit with a first floor to be used for storage and a landlord requirement for a double height display window.. Access to external air was provided by means of a duct route to the roof, with no access to external daylight and a rear access corridor to a delivery yard.
7. A new concept installed in a store a few units along from a unit that had been occupied by the retailer for some time to bring the store nearer to a major department store in a high street location. This sales floor was split onto three levels into a half basement with a first floor stock and staff welfare area.
8. A new contractor was used for this project following a gap of two years in any new store development and with some modification to furniture details. This store is located on a new build retail development with external frontage in an exposed location.
9. A store replacing project one in a new location in the same city utilising an historical street location over three floors.
10. A small store situated deep within a retail mall.

Plans of each store are to be found in the appendix.

Project Description	Gross area m2	Net Retail area m2	Net/gross ratio	Gross build £/m2	Net retail £/m2	Electrical installation £/m2
1. New Build, Mall, 2000	212	141.5	67%	1155	1738	243
2. Strip-out & refit, Mall, 2000	200	135.5	67%	1044	1547	283
3. Strip-out & refit, High Street, 2000	405	192	35%	552	1165	364
4. Refit, Outlet Centre, 2000	147	112.5	76%	602	787	272
5. Refit, High Street, 2001	409	284	52%	734	1948	243
6. New build, Mall, 2001	154	150	49%	783	1289	283
7. Strip-out, refit - new concept, High Street, 2002	403	187	60%	759	1636	364
8. Refit, Mall, 2004	187	130	69%	1306	1880	272
9. Refit, High Street, 2005	439	274	63%	923	1476	243
10. New build retail development, 2005	326	262	80%	1311	1630	283
Average (Excluding 4. outlet store)	311	185	59%	950	1547	364

Table 5-1 Traditional efficacy data

5.2.4 Project Content

Shop frontage design where external, was provided in metal framed single glazed toughened and laminated security glass. In the mall projects 1, 2 and 6 a timber frame was used due to Landlords' requirements, and the high street stores3, 5 and 7 reused an existing shop front. Lighting from previous tenants would be utilised where possible, especially in back-of-house areas to minimise capital expenditure. Front of house light fittings were also set aside for reuse in re-fit projects although this is not always found to be effective as lighting installations may not have been carried out properly by previous tenants causing addition work to be carried out to make the installation safe or adequate. Lamp life was a major issue in shop front displays where halogen spotlighting was typically used for visual effect. It was felt by the store manager that if a lamp was not functioning that the impact of the visual display and the quality image of the store would be severely compromised. Research of lamp types available for later projects allowed a better lamp to be sourced. However, the problem was not entirely eradicated.

Air-conditioning systems would be utilised and existing systems modified where possible and were thermostatically controlled. Special attention was given to providing cooling (via location of outlets) for the fitting rooms as this was reported by store managers in existing stores to promote sales. It was common practice for the front door to stand open to invite custom; therefore a hot air curtain would be provided to street frontage stores and be manually controlled by the store manager.

Floor finishes specification comparison was made between using oiled North American hardwood flooring and a very close match photographic vinyl sheet laid in strips. The high street stores all suffered from water damage to the floor at the entrances and one store had a major flood from a property above which caused expansion ridging in the floor planks, this damage was polished out once dry, but was a tripping hazard until the work could be carried out. The alternative flooring was cheaper and easier to install but would still require a ply deck and battens for cables to mid-floor power and data positions. It also was much lower maintenance and less prone to water damage. On presentation with this data, the retailer chose to use the Amtico in the outlet store and in display areas where their customers would not be able to see the difference. This cost difference was a major contribution to the reduced cost of the outlet centre store (no. 4). Loose furniture, such as display tables and framed mirrors, could be stored and reused in other stores. Re-polishing of furniture was investigated, but proved to be more expensive than new manufacture. Storage costs also had to be taken into account. In one case, furniture no longer required was sold to customers.

5.2.5 Opportunities for Reducing Environmental Impact

Paint specification of brilliant white matt emulsion, was chosen on the understanding that re-painting of high impact areas would occur as necessary, however, furniture and mannequin positioning could keep walls out of reach. This colour is highly susceptible to marking and areas that are not screened by placing furniture or mannequins are quickly spoilt, requiring regular touching-in or repainting. An alternative product might be a toughened acrylic paint as it is more washable than vinyl matt. The cost of the alternative paints is not significantly different but in theory, the maintenance would be better than repainting. However, it could also be assumed that the effort and time required to touch-in a mark is not dissimilar to scrubbing although both processes might represent a further risk of damage to surroundings and stock. It is necessary to de-stock the area, protect floors and other finishes and provide access for the decorator out of normal trading hours whether the area is being spot touched, scrubbed or repainted. Natural paints are available in a narrow range of colours including white, but tend towards chalkiness which is not acceptable in a retail environment due risk of stock damage. Prices have become more comparable to trade ranges but there would appear to be a resistance to move to their use in commercial contracts despite the obvious health benefits to operatives, they were not investigated in this case.

The second element which might be anticipated to demonstrate whole life cost savings is in the flooring specification. The timber flooring requires regular buffing with a motorised polisher and occasional re-oiling. The vinyl substitute requires mopping and buffing with the same machine. This could not be expected to offer significant differences in actual maintenance costs. Maintenance costs are difficult to estimate as many cleaning tasks are carried out by shop staff as part of their duties in small stores rather than by contract cleaners and can vary in cost a great deal from one city to another. The project design life is generally shorter than any of the specified products' replacement life, rendering replacement cost comparisons irrelevant and the introduction of net present values quite meaningless. It can be concluded that, intuitive reasoning and cost benefit analysis using product literature are more applicable to small retail projects.

No comparison had been made of the actual energy use of the stores and this was never a concern stated by the retailer during the design and construction of the projects. Using average monthly electricity billing data made available by the retailer for 2006, it is possible to account for electrical and CO_2 output for a number of existing stores. The same energy supplier is used for all stores, and it would appear that typical values for stores with an external entrance are wide ranging, but that the two most northerly and presumably most at risk to open door heat and fabric heat losses have the highest kWh/m^2 rate This is also a reflection of the historical fabric of store five offering a poor thermal efficacy and the large area of external wall and landlords single glazed shop front of store ten. The whole chain of stores is averaging about 307kWh/m2 and or 124 $kgCO_2$/m2/year, which according to Roaf (2004) is within the normal range for non-food retail, however, the most recent stores demonstrate an improved performance. For the purposes of carbon accounting, based on a 25% reduction from those averages would result in a total energy usage of 230kWh/m2 or 93kgCO2/m2/year. However the average efficiency of the last three stores completed since 2004 is 231kWh/m2 and a further reduction to 173kWh/m2 would be a more appropriate benchmark for the next store. It is important to note that this would not be the TER target efficiency rate for Part L2B as it also includes energy used in small power, security and fire safety systems which are not included in the National Calculation method (BRE, 2007).

The standard detail and specification floor material for the roll-out programme for these stores was American or Canadian Red Oak in 200mm wide planks. This product was laid on battens to allow cables to run underneath and finished with oil and buffed. The material was part of the nautical image of the brand and had been selected by the concept designer based overseas. An alternative of a sheet vinyl product Amtico or similar product could have allowed a shallower build-up of the floor, which was often problematic at the entrances and fire escapes. However, the maintenance advantages would be enormous in stores that had minimal areas of entrance matting, water damage was common, and the care of the flooring required regular oiling and buffing by an outside cleaning contractor. In one store, a flood caused the boards to curl up at the sides, however, re-sanding of the area and oiling and buffing resulted in a good repair. It re-enforced the principle that the whole floor are could be re-sanded if the floor had general wear and tear. The sheet flooring is made up from reclaimed PVC based materials and, if laid appropriately, can also be recycled. However, in practice, skip segregation of treated timber products, or removal for reuse by the contractor would result in loss of any reclaim value of the material to the retailer. It is likely that it would actually be borne as a waste removal cost by the contractor. The alternative vinyl flooring product was made of recycled plastics, and if not bonded directly to the substrate, could also be recycled again. However this was not thought to be instrumental in the decision to use either product. The floor specification was revised from 2004 to walnut solid wood; so old store flooring now cannot be reused in new stores. When project one was vacated, the floor was left in, presumably the incoming tenant will have re-used the floor or the shop-fitter stripped it out for re-use elsewhere or scrap. The concept design had specified a great deal of timber, which is sustainable in itself, and the floor was finished with a natural oil product, however it was without exception imported which would have given a higher embodied energy. However this was never the subject of any investigation. Water use was very low in that there was provision of a staff toilet and basic tea making facilities in each store, mainly were existing toilets except in the new build projects and there were provided as one disabled access toilet. No monitoring of water use was carried out; in some stores there was a service charge to the landlord rather than a meter preventing any monitoring. It might be possible to reduce the flushing capacity of the older toilets with cistern inserts, and modify taps, however there might not be a significant cost saving for a number of years.

No structured Social Impact Assessment was carried out, but the retailer believed that it had a very good understanding of their key customer groups due to the very personal and direct sales style that was employed. This resulted in the level of consideration given to the level of finish, lighting, comfort and privacy provided by sales floor fitting rooms. They had also registered a level of dissatisfaction with display lighting that had a pink reflector tone giving poor colour rendering of dark colours leading to design development of similar lighting in later projects. No multi criteria analysis was carried out in any form during the course of the projects.

This investigation suggests that whilst environmental considerations are sometimes made in retail projects, they are not necessarily rigorously recorded or tested and that they might be expected to have some degree of intuitive discursive analysis occurring in the design process. This investigation has only studied one specific form for one retailer and therefore is not representative of the whole of the industry; the next investigation widens this scope to case studies from within one organization.

5.2.6 Findings

This investigation provided the following findings, but they need to be substantiated by further investigations

1. Retailers have a clear and fairly fixed idea of the image they wish to give, which leads to the use of a standardised concept, but this needs to be updated periodically leading to short replacement cycles.
2. Retailers also have a clear idea of the sort of customer they seek to attract and the sort of site, location and city they feel that should be carried out from, however the sites selected can sometimes become less effective and the store fail to be viable, again leading to short replacement cycles.
3. Maintenance and cleaning routine is not straightforward enough to base whole life costing calculation on, and the short replacement cycles prevent use of net present value therefore cost benefit is a more acceptable selection criteria.
4. The benefits of recycling materials at the end of a project life may not be felt by the retailer, but there is potential to re-use and modify existing arrangements if this can be adequately planned. However there may not be any long term economy in reusing HVAC systems or lighting.

The implications for the design methodology framework are that there must be an adequate level of flexibility to deal with the idiosyncrasies of a variety of locations whilst managing the need for uniformity of the concept design. There must also be opportunities

Store type and location	Gross area	Average monthly cost and kWh for 2004-5 @ 7.5p kWh	Average monthly cost and kWh for 2005-6 @ 9p kWh	Electrical installation cost £/m2 of retail area	Annual Kwh/m2 May 2005-6	Output kg CO_2/m2/year	Annual Output in tonnes of Carbon
1. New Build, Mall	212	Not in use		240			
2. Strip & fit-out, Mall,	200	£486 6480 kWh	£554 6155 kWh	243	369	156	8.5 tonnes
3. Strip & fit-out, High Street	405	£662 8827 kWh	£807 8967 kWh	283	266	112	12.4 tonnes
4. Refit, Outlet centre	147	Included in service charge		142			
5. Refit, High Street	409	£925 12333 kWh	£1212 13467 kWh	364	395	167	18.6 tonnes
6. New build, Mall		Not in use					
7. Strip-out, refit - new concept, High Street	154	£467 6227 kWh	£490 5444 kWh	245	424	179	7.5 tonnes
8. re-fit, Mall	200	£244 3253 kWh	£275 3056 kWh	272	183	77	4.2 tonnes
9. Refit, High Street	405	£469 6253 kWh	£582 6467	243	191	81	8.9 tonnes
10. New Build, retail development	409	£892 11893 kWh	£984 10933	283	321	96	10.8 tonnes
Average	403	£592 7893 kWh	£701 7784 kWh	364	307	124	10 tonnes

Table 5-2 Energy efficiency data. Conversion at 0.422 kg CO2/kWh using SAP data (EST 2006)

to maximise potential for recycling and re-use, but minimise risk of failure to comply with legislation. These sore demonstrate that there is a need to manage the design process repeatedly for each store and that they cannot be seen as a merely a replication of concept.

5.3 Investigation 2: Case Studies

5.3.1 Aim, objectives and anticipated outcomes

The aim of this investigation was to understand the content and process in the design and procurement of a broader range of retailers and retail forms. These are selected from the retail projects carried out by architectural practice Simons Design Ltd during the period of the research. The objectives were;

1. To investigate any environmental analysis that took place and how this informed the design of the projects.
2. To understand what factors effected decision making when faced with data pertinent to sustainability.
3. To document the way the sustainability issues in question were dealt with by the procurement team and highlight any significant incidents or if the identified evaluation methods were used in any form.

Evidence was based on the information held in project files and drawings and observations recorded by the individuals involved in the projects. The anticipated outcome was a demonstration of design changes being incorporated based on evidence provided by stakeholders relating to sustainability.

5.3.2 Research tactics

The projects were selected on a basis of availability, in that they are the projects that the author and colleagues have access. As well as being for a variety of retailers they demonstrate differing complexity, locations and procurement method. The evidence is taken from documentation, interviews and direct observations. Where interviews are the main source of evidence, it was hoped that perceived causal inference would provide useful in summarising themes. There is a possibility of bias and inaccuracy particularly where recalled events are concerned. Where direct observation is the main source of evidence and particularly in the ongoing projects, reflexivity (Yin, 2003) may be evident, but that is not necessarily due to this research as other observations are being undertaken simultaneously on other themes by third parties. Discussion of the significance of the events and how they relate to the criteria developed in chapter two is included in each case study. However, as in all cases, the respondents had a central role in the project and in general taking the professional role of "Architect", it must be assumed that this is a fair and impartial representation of each individual case. The interviews were carried out as an informal discussion where the design consultant was encouraged to relate the history of the issue and the strategies used to deal with it and how effective they believed the results to be. This has resulted in a series of case studies that are described from a single viewpoint and therefore are not necessarily balanced in opinion.

This investigation was intended to understand how a design solution to a sustainability issue evolves through the project life and how and why specific design issues are tackled and decisions made. It was hoped that this might illuminate how and why opportunities for sustainability are achieved or rejected and how they could be controlled by an alternative approach. Limitations on anonymity prevent plans being published which would identify the stores.

5.3.3 Example 1: Large department store and waste separation, 2004

The new shopping centre anchor department store project had been intended by the developer's architect to have a combined refuse compactor installed in the loading bay for periodic collection, and a space allocation had been provided in the service area for that purpose. When the time came to instruct the main contractor to obtain quotes for the equipment, it became apparent that the available models would not fit in the orientation and size of the space due to the location of a fire door and escape route out of the service yard. This could have resulted in lengthy and costly modifications to the landlord's shell. Instead the waste disposal company proposed as an alternative cardboard and plastics bailers and standard wheeled paladins for food waste collection by the local authority.

The recyclable waste was to be collected by a third party and could generate a small income which was calculated to cover the cost of the installation in a couple of years if prices for the reclaimed materials remained static. There was some concern from the store management team, who had by that time taken partial possession in the scheme (to commence back of house operations three months prior to store opening) already appointed and involved in the decision making process, that there would be a training and staff time issue, however, as the alternative was both very costly and had significant programme implications affecting store opening dates, it was agreed that the bailers were the only viable alternative. This took place in time to coincide with much of the lighting installation by the contractor and deliveries of furniture and fixturing, both of which generated large volumes of packaging waste. The contractor would normally have dealt with both in separate manually compacted skips. Now they were able to use the bailers to deal with this bulky waste, and the retailer allowed the contractor preferential use of the bailers until handover, so the contractor benefited from the income and found the system useful in maintaining a tidy site at a time when so much packaging waste is often problematic due the space it takes in skips. Future projects are likely to have bailers as a result, although in developer's schemes, a central depot for recycling is becoming more common, where the service charge reflects any income generated. The contractor was so pleased with the bailers that they were considering temporary installation particularly for some of their sites where time and space might normally make segregated skips impossible.

This example demonstrates that a solution can be found because of the identification of a problem. Waste management s increasingly an issue for retailers, but the options available might vary geographically. In more recent development schemes for this retailer, options for alternatives to one single compactor are being offered by development design teams. This change in policy is understood to be partly due to the Department store's waste separation programme, new legislation on waste management, and the need for the development scheme designers to demonstrate sustainability at planning stages.

5.3.4 Example 2: DIY store and alternative energy options 2004-6

A large DIY retailer, planning a new store was asked by the planning authority to consider alternatives with academics and energy conservation organisations at the nearby university. The retailer had a fairly well considered environmental policy which looked at carbon emissions/m^2 and how this could be reduced using various methods. The first potential consideration was CHP for the store using either wood chippings or bio-diesel. This would require storage and delivery of the fuel to be considered and there was no useful way to deal with the heat produced except to allow the car park to be kept frost-free in winter and heat the small welfare area. The second option, which was a wind turbine would have allowed surplus energy could also have been sold back to the grid at a premium, but local opinion was unfavourable. Although this would have a visible message for renewable generation, planning permission could have been complicated by public consultation. The shell was being built by a developer so the investment of the plant would need to be by the tenant store. The significant increase in budget was not acceptable. Availability and delivery of an acceptable carbon neutral fuel was in question.

Energy use was instead reduced to a minimum by other elements such as a how heating and lighting were managed locally and on timers. Offices formed a small part of the building was actively maintained for workplace requirements but heat exchange could be employed in this area. Customers were expected to visit in outdoor clothes and only minimal heating was provided in the cash desk areas. The doors were lobbied, and the shell insulation was traded against window space and roof light provision to minimise lighting requirement in the hours of daylight. Heat recovery was employed to benefit welfare accommodation and the sales desk areas. It was proposed that a ground water bore could be used to exchange heat and cooling reducing electrical load further but this was not pursued after it was priced by a specialist and found to be disproportionately expensive for the emissions saving potential offered.

The one significant operational issue that made energy use and heat gain an issue was the display of lighting products for sale. The question being, can lighting products be effectively merchandised if the customer cannot see it switched on, or could other display methods have been used, such as catalogue based photography. In other stores the retailer had positioned smoke vents in this area with a low heat detection setting to naturally vent excess heat generated and the circuit for the display lighting had reduced power to a minimum by putting low energy lamps only in a small selection of fittings.

The planning application was submitted and approved. However, as the specific sustainability measures described in the planning scheme were not stated as conditional to the approval, and the developer has not listed the items in the employers requirements there was initially some difficulty in retaining the measures in the brief. Whilst the initial scheme would have offered a very comprehensive energy management strategy, the final outcome used only a very good heat recovery installation. The retailer has an ongoing requirement for all new stores to have a BREEAM assessment and achieve a very good or excellent rating and an excellent rating (of 84% or more) will be achieved by this store. This example demonstrates that connectedness and documentation is necessary between policy and actual implementation to ensure the sustainable measures are maintained, but that the retailer's requirement for the assessment forced the contractor to retain parts of the brief.

Example 3: Low cost sports retailer 2001-4

A long-standing design concept and a wide ranging roll-out programme using a number of designers and contractors for this low budget store had used grey-black natural slate flooring for many years. This flooring was originally sourced in India, however, a natural disaster at the quarry had caused it to close and a second supplier also in India was found. The retailer was pleased to find that the new supplier was cheaper, however it soon became evident that the quality of the material was poor and a great deal of wastage was resultant. As part of the display methodology was the use of ladders to hang clothing at high level, uniformity of the finish was important, as was securing a safe surface for the public to walk on. The designers for the implementation of the roll-out programme had become accustomed ton including this element in the Design Risk assessment as a matter that required close supervision by the contractor to ensure a safe floor finish. An alternative was suggested for vinyl sheet flooring laid as tiles with a jointing strip with highly effective photographic slate effect; this was rejected at first as it appeared to be more expensive, however, at one store, it was necessary to install this floor due to weight restrictions on a mezzanine floor. The speed of fitting and lack of wastage and visual effectiveness of the flooring was so great that it was quickly implemented throughout the national roll-out programme. It has since been found to save on maintenance and repair costs as the old slate specification was prone to delaminating in heavily trafficked areas.

Again this example demonstrates that retailers are wary of change in concept design, and are often guided by initial cost over maintenance. Because the new material specified was non-PVC, the environmental benefits could be recognised, not least in the reduced transport energy and environmental impact of the products, and potential for recycling when the stores were refurbished.

5.3.5 Example 4: Food and Non-food Retail Distribution Sheds 2005-6

In this case, the developer was working closely with the end-user to establish how the energy, embodied energy, water use and internal environment could be improved by taking a more sustainable approach to design and construction. Earlier examples for the same end-user in Germany were demonstrating reduction in energy as much as 50% and water use 45%. The first sites in the UK were showing similar water savings using rainwater collection and water saving sanitary fittings but only around 6% energy savings, which were insufficient to pass the forthcoming changes to Part L of building regulations. The contractor had been challenged by the developer to work out what could be done on future projects using the supply chain.

An initial meeting highlighted the following issues;

1. To understand where the biggest gains could be made, a breakdown of energy use was required either by calculation or sub-metering which would take a year to carry out rigorously.
2. To understand design problems and management issues that were potentially causing heat/cooling and lighting energy to be wasted an observational survey of a number of recently completed existing sites was required. Non- constructional

air tightness was though to be significant as many loading doors were open most of the time.

3. Energy and water used in the building process could be considered, but were not thought to be significant to the larger picture as hardly any wet trades were involved.
4. Embodied energy in building materials should be investigated through the supply chain and opportunities for reduction to be sought.
5. The construction management personnel involved on site needed education and training in the issues of sustainability and simple WLC and LCC calculations and understanding ideas such as Carbon Footprints and Embodied Energy to become conversant.
6. Waste resource control was insufficiently carried out on previous sites; this was an opportunity that could be implemented immediately.

5.3.6 Findings

It is apparent that cost is the prime driver in many projects and dealing with this issue is of paramount importance in the design of any analysis method. In the case of the small high quality store, the brand and image was the overriding principle. In such a case, a demonstration of the weighted argument used or criteria required for selecting a given material over another might be a better method. In the case of the waste separation initiative, if the problem had been identified at an earlier stage, there might have been a way to create the space required for the traditional combined waste compactor skip, and consequently there would have been a lost opportunity for waste separation. This highlights the need to consider multiple solutions to problems and weighing up the benefits of each. These case studies further justify that the following assumptions are true;

1. That formal environmental analysis does not take place in most projects.
2. That documentation is necessary to ensure sustainable measures are included at construction and that should occur early in the development of the scheme.

3. That the disjointed procurement process allows negative effects of cost cutting of capital cost to override longer term benefits and eliminate environmentally benign conceptual ideas.
4. Conversely, tenacious adherence to conceptual ideas can be used to refuse sustainability measures.
5. That the tight programming of projects is detrimental to inclusion of sustainability measures that require some detailed investigation.
6. That planning and building control legislation needs to be tighter to enforce conservative use of carbon producing fuels.

The case studies demonstrate that a technocentric approach to reducing environmental impact is most commonly taken, and that it is a reaction to changing legislative requirements rather than *active* or *proactive*. This might be described as a transformation point, but it is externally imposed and therefore is still a *passive philosophy* in that it is doing the minimum that is required. Futurity in the retail development was significantly greater than the fit-out projects but the distribution facility had the most comprehensive proactive approach, but was again looking to technology to reduce environmental impact.

For the design methodology framework this issue of reactionary passivity implies that it is often the perceived problems which help to generate the more sustainable solutions because without problems posed by legislation, site or supply difficulties, the business as usual approach prevails to rolling out retailers' projects under tight programme and cost constraints. Therefore it is necessary to highlight as many problems or risks at the out set of each project as possible to cause opportunities to find better solutions to problems to be obtained.

5.4 Investigation 3: Consultant Opinion Survey

5.4.1 Aim, objectives and anticipated outcomes

This investigation aimed to define the extent of environmental evaluation that was taking place in the retail sector to demonstrate transferability of the findings of the previous investigation are true for retail architecture across the UK. The objectives were;

1. To validate assertions made about the retail construction industry.
2. To establish the extent of use of existing methods of environmental evaluation.
3. To determine the priorities assumed to be placed on design criteria by retail consultants.
4. To determine how consultants believe their retail client would place the same design criteria.
5. To determine the view of consultants on what will be the drivers for change in environmental design and integration of sustainability measures.

5.4.2 Research tactics

The survey was carried out as a self-completion survey. This was be issued by e-mail with an open invitation to complete the survey. This method was selected to reach the greatest number of possible respondents nationally, with the minimum cost and time.

A basic word document was used for simplicity and clarity. Inserting text and deleting words as required is within the normal range of computer literacy of construction professionals (Appendix I). As a failsafe measure, the option to print and fax back was also included. The survey was accompanied by a brief statement of the purpose of the survey. The wording of the statement was controlled to avoid suggesting what kinds of answers were expected. In all, 121 Architectural practices were registered as retail specialists in the trade directory Shop Spec (2004). An e-mail questionnaire was sent to 115 of those with an e-mail address published. 68 were registered as received. One week later a fax version was sent to 96 practices which had fax contact details. This repeated the request to 70% of the practices. As response rates remained very low a further 12 companies were contacted directly, these were selected by taking every 10th listing in the directory. One in 10 of the companies listed in the same trade directory were contacted directly for a fax or e-mail to be sent to a named person. Quantity Surveyors and project managers were selected by directly contacting the practices that were named by a website search engine as retail specialists run by the RICS.

5.4.3 Confidentiality

There was a confidentiality statement describing how information would be kept and used. In order to keep the questionnaires confidential, the respondents were asked not to rename their response when saving the document and return by e-mail. The responses were saved as sequential number for data collection. It was impossible to assure respondents of complete anonymity with electronic responses. The questions were worded to avoid any reference to identity and the data required is no more detailed than what might be included in a normal project press release. However, several respondents named their submission by choice, and some even named their retail clients.

5.4.4 Limitations

This form of self-completion survey is well known to be limited by low response rates. For this reason it was unlikely that any statistical correlation could be achieved. Reaction to receiving this form of e-mail will result in either a prompt response or none at all. For this reason it is not acceptable to make repeated requests or reminders for the survey to be completed as this may cause annoyance to busy people. As the range of companies available is biased towards architects, more architectural respondents may be expected. It could be anticipated that the respondents were interested in this subject and this may further bias the response profile.

5.4.5 Reliability

In order to understand how results varied between respondent job roles, the Contractor, Quantity Surveyor and Project architect of a department store project completed the questionnaire to compare how the results varied for the different parties.

5.4.6 Questionnaire details

The questionnaire was separated into three sections

Section 1: About you and your place of work;

The purpose of this section is to get as much information about the respondent's work and workplace without breeching confidentiality. (Referring to survey in the appendix) This section is aimed at developing a clear picture of a number of projects and how their various specific circumstances effect the way they are designed built and managed.

Section 2: About the project;

This section was designed to gain factual information such as the size and value of a project. It also asked how long the life of the fit-out was and how maintenance was carried out.

Section 3: Client values;

This section was aimed at finding out what the construction industry professionals perceive to be the values of their retail clients. This is important in two ways, firstly to allow comparison with similar questions aimed at retailers, and in conjunction with those results allow weightings to be calculated for general retail design or specific groups within.

5.4.7 Results

The data matrix is to be found in the appendix. Response rate were low at 9.2% (12 out of 123) shown in Table 5-3 , which had been anticipated to be problematic. Out of twelve respondents, nine (75%) claimed to have an environmental policy (Figure 5-2). Perhaps the key feature was to gain the perception of the four levels of profundity defined in the framework of chapter 2; *Passive, Active, Proactive* and *Industry Leader* with a further *don't know* option.

	no. issued	no. returned
Architects	96	6 (6.25%)
Contractors	11	3 (27%)
Quantity Surveyor/Project Manager	6	2 (33%)
Interior Designers	10	1 (10%)
Total	**123**	**12 (9.2%)**

Table 5-3 Job type of respondents (consultant opinion survey)

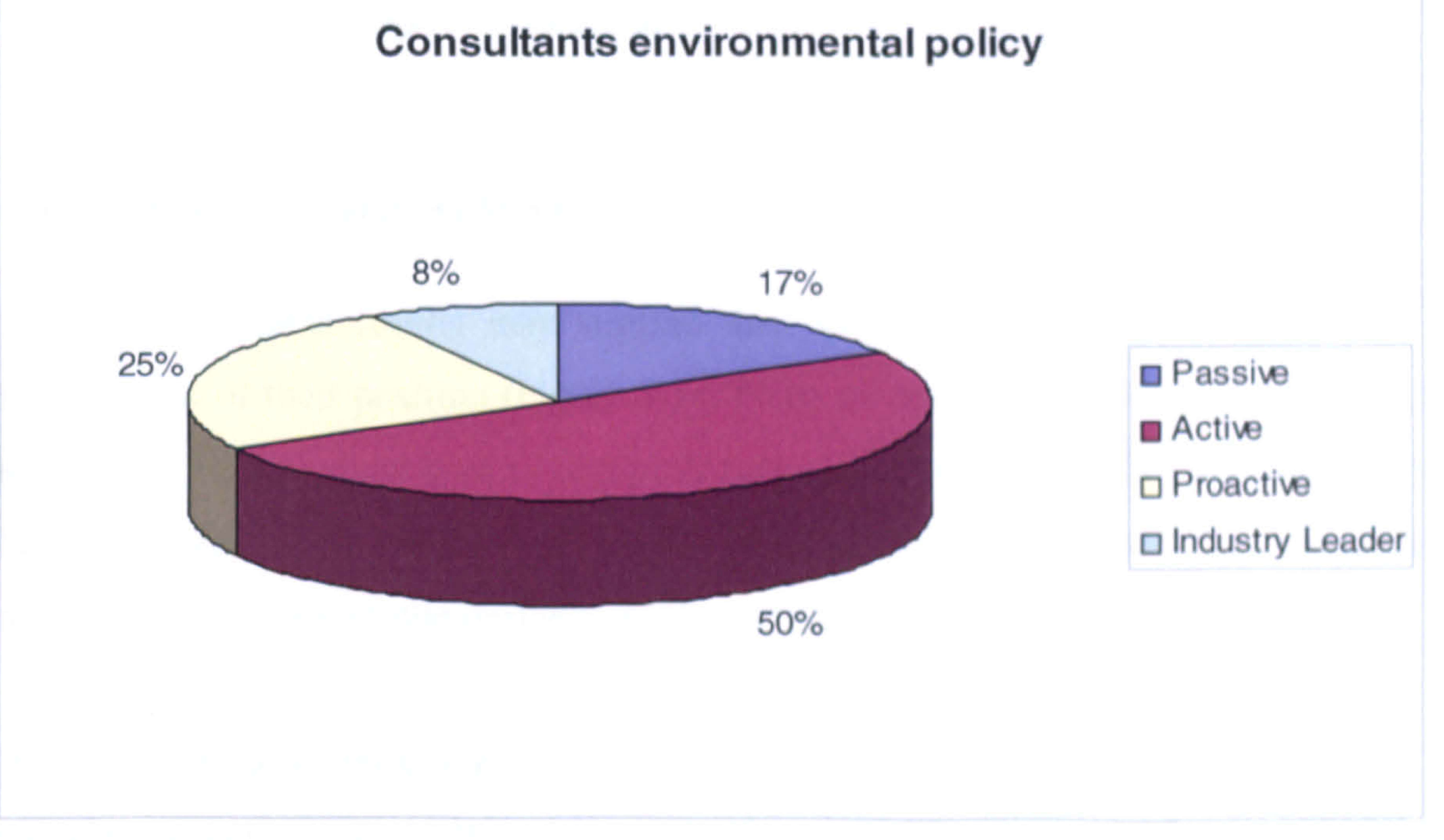


Figure 5-2 Environmental policy (consultant opinion survey)

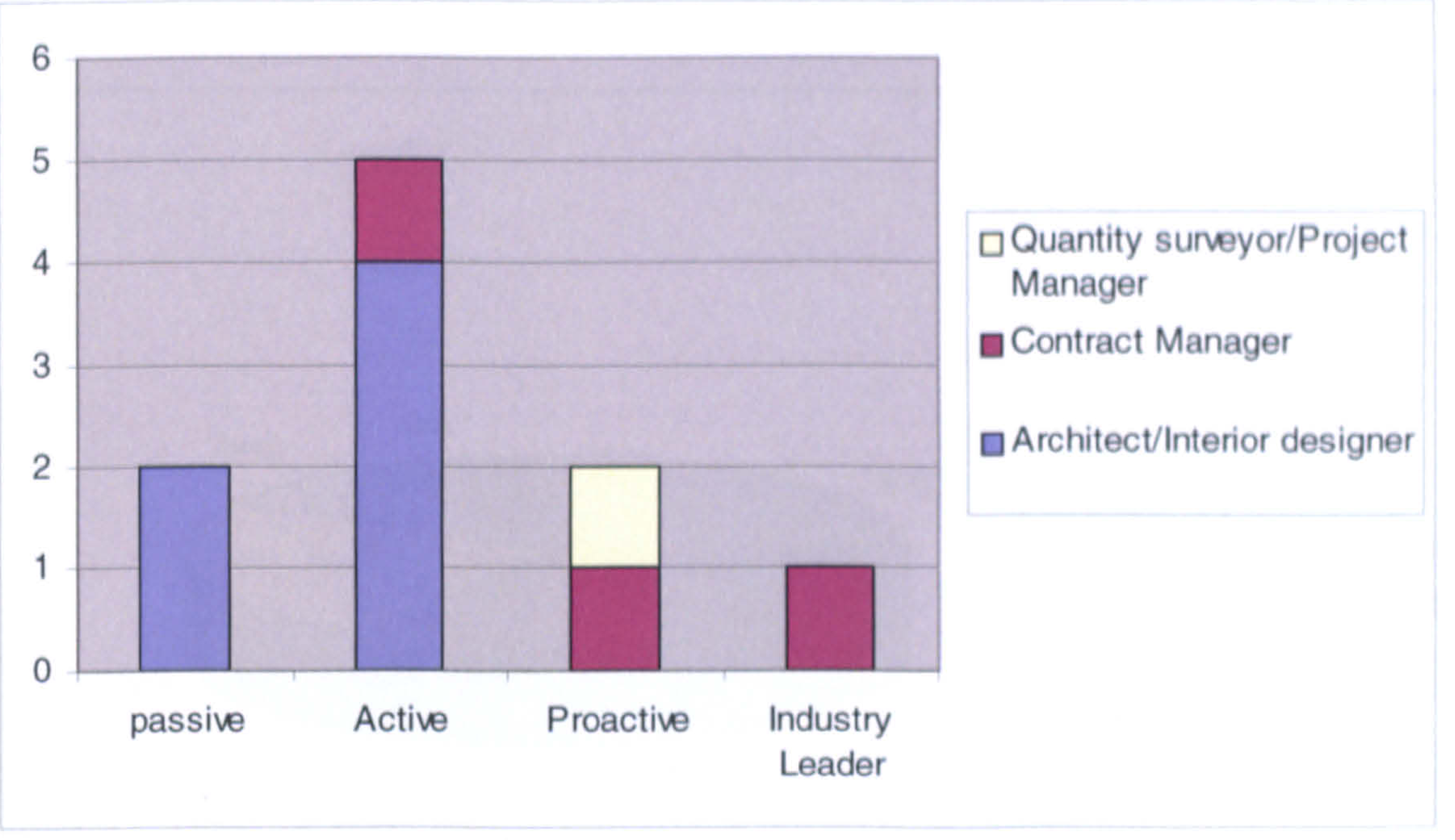


Figure 5-3 Environmental policy by job role (consultants opinion survey)

The nature of these results may suggest that architects have a more cynical or less inflated view of their position (Figure 5-3). To be an industry leader in construction may be an easier achievement than in design. It may also represent the fact that the architects that responded have a mostly retail based workload and by nature are not competing for industry leading sustainable design work to be found outside of the retail sector.

The responses were mostly regarding Retail Use category A1 stores (Figure 5-4). The average cost per m^2 was £1463 with a range from £150 for a supermarket to £3230 for an A1 mixed retail store. Facilities were found to be generally managed in-store and larger stores tend to have a specific member of staff. Architects are unlikely to know how maintenance will be managed. Only 16% were stated to have reactive maintenance despite this being a growth industry, 3 out of 12 (25%) were expected to have planned maintenance. As this is often a contractual arrangement awarded by the retailer after completion, it could be expected that many of the project team would not get to know if indeed it had been decided at the point of completing the survey how maintenance would be managed. Fifty percent of the architects did not know the life cycle of their project, the contractors all supplied a life expectancy. The combined data would suggest that most projects have a 5-10 year life. Standard details were used in 50 percent of cases.

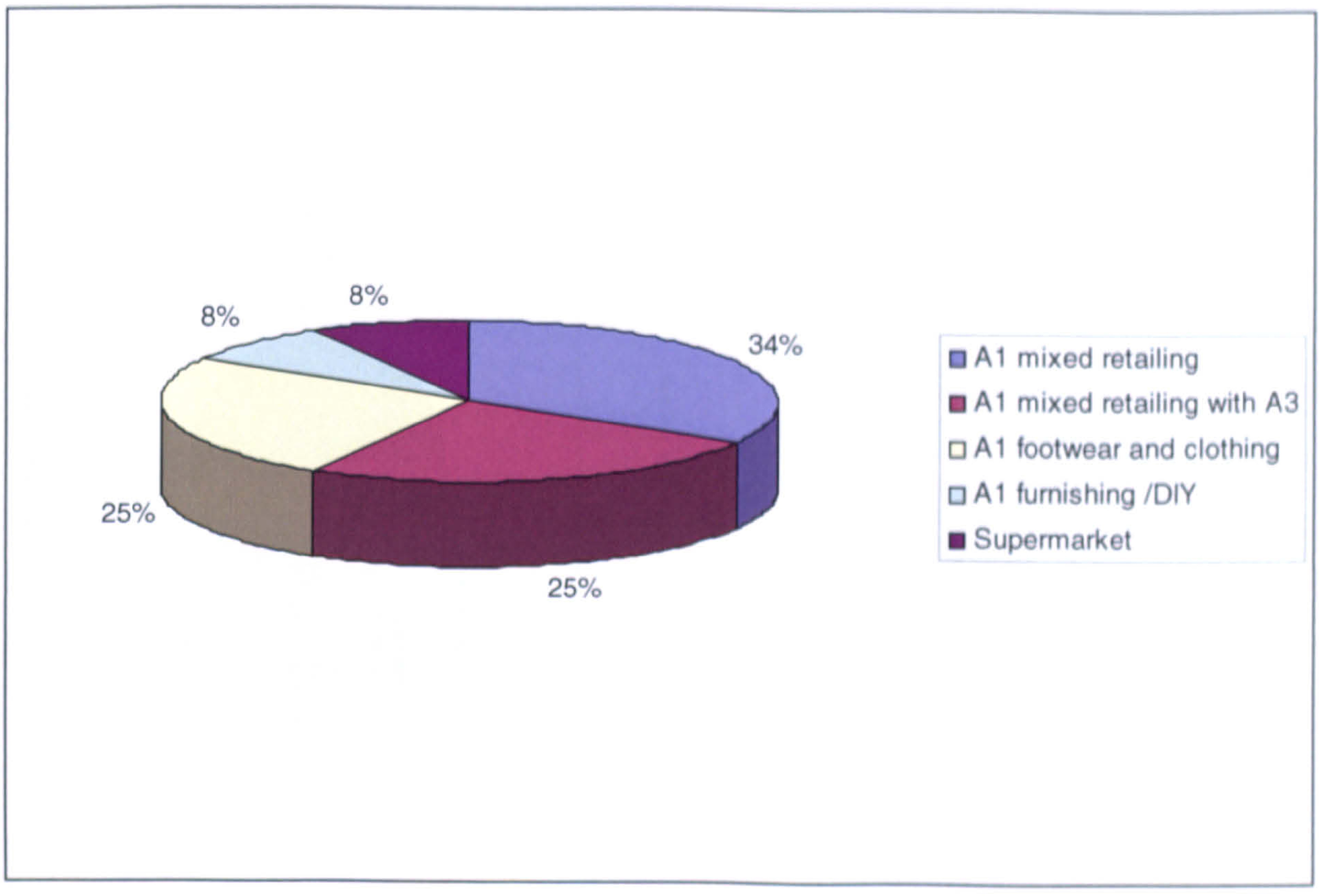


Figure 5-4 Project types (consultant opinion survey)

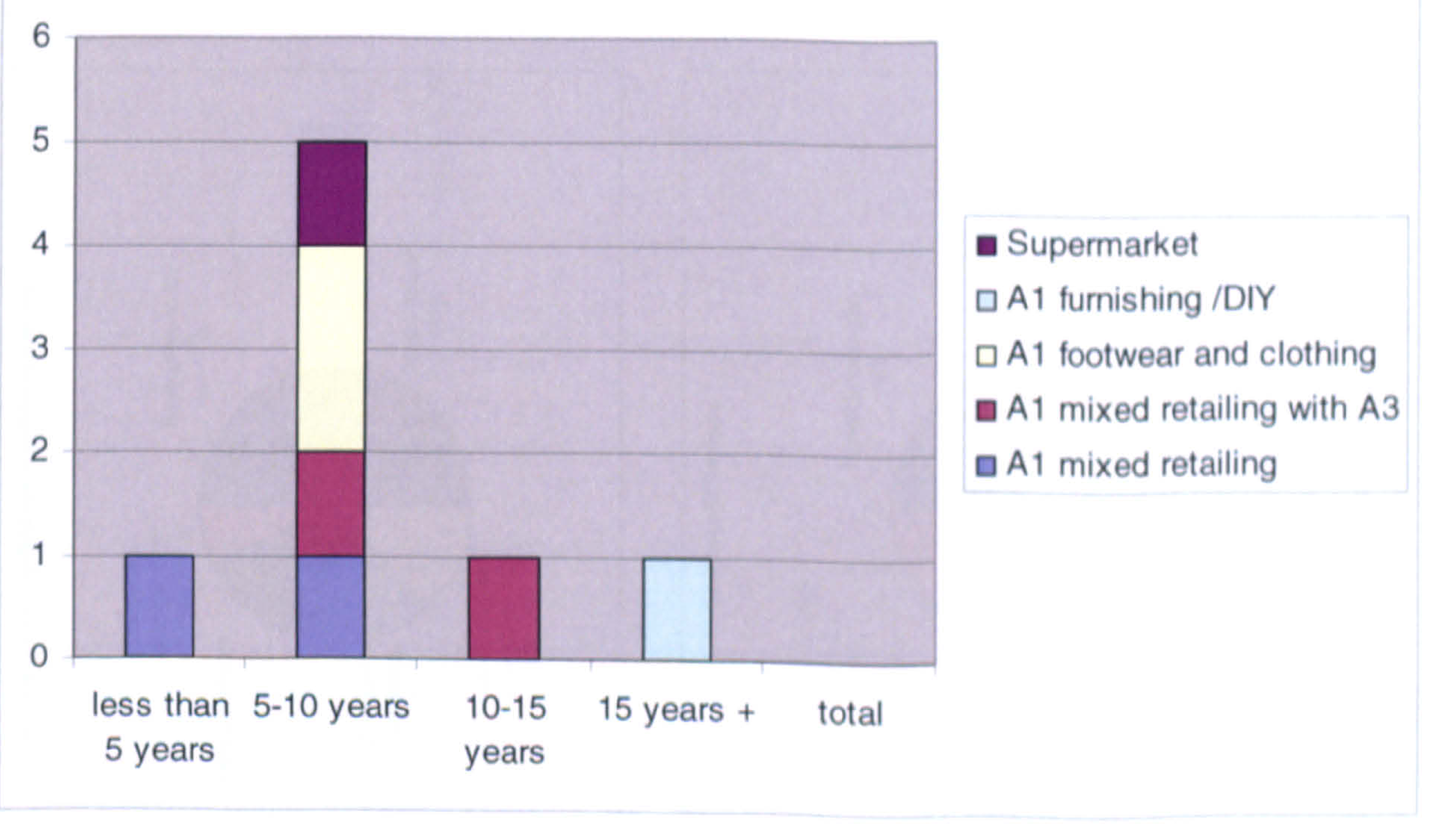


Figure 5-5 Project design life by consultants

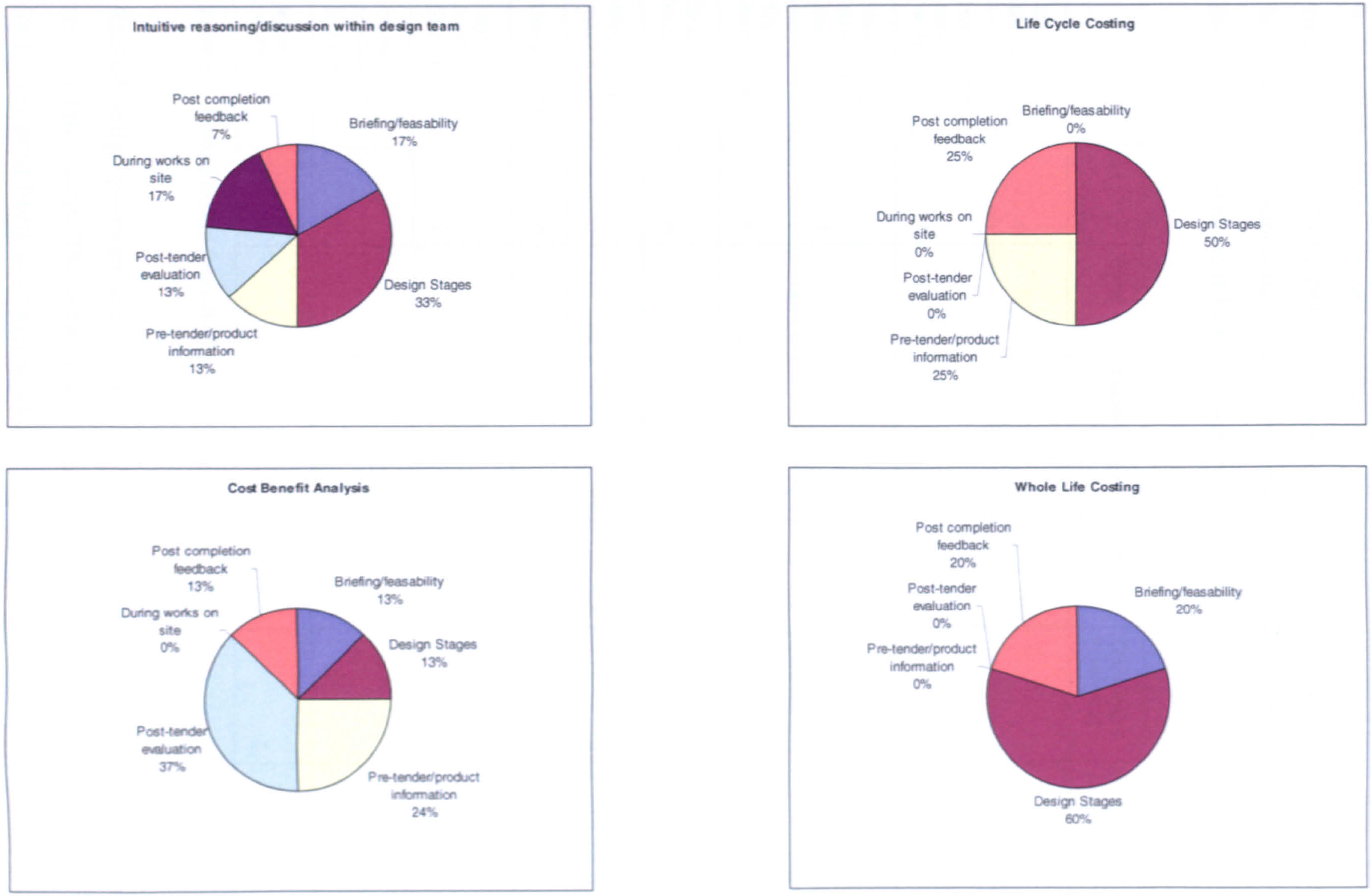


Table 5-4 Comparison of environmental analysis methods by design programme implementation (consultant opinion survey)

The largest proportion of the analytical work appears to occur in the design stages and it is far more likely to be intuitive or through discussion rather than formalized methodologies. The exception for this is value and cost comparisons made post tender. None of the respondents had used Multi-criteria analysis forms or BREEAM for retail for the projects they had described in the survey.

	A1	Bank	Supermarket	DIY	Clothing & Footwear	Mixed Use	Overall rank
Minimising capital cost	1	1	1	12	1	5	2
maximising resale or rental value	11	12	2	12	10	11	11
Maximising store layout net to gross	3	1	5	12	7	3	3
Maximising turnover m2	5	12	6	1	11	1	7
linear metres of display	8	12	7	1	1	9	9
Minimising maintenance	10	12	10	1	4		8
Design impact	6	12	4	1	4	8	5
Layout flexibility and demountability	2	1	3	1	3	1	1
Image positioning and brand	9	1	11	12	7	10	10
Minimising capital cost	4	12	9	1	6	3	5

Table 5-5 Ranked design priorities by retail type

Ranked design priorities are set out on Table 5-5. These results were fairly consistent across retail sectors. The whole samples accumulated scores gave the following ranking for factors most likely to change sustainability in retail facilities. It is interesting how low increased fuel costs are ranked. A1 mixed retailing (typically department stores) put top three; Saving running costs, Corporate responsibility and Marketing tool. For changing priorities Employee demand (100% listed as first priority) Customer demand and Stricter building control requirement on services. The bank respondent ranked corporate responsibility first, the supermarket respondent chose employee demand first followed by stricter planning controls whist the DIY store respondent ranked customer demand ahead of employees and then stricter building regulations as the most likely factors to change sustainability in new stores. Clothing and footwear respondents' ranked customer and employee demand ahead of tax gains and grants.

Now	Future
Marketing tool	Employee demand
Saving Running costs	Customer demand
Corporate responsibility	Attractive tax incentives
Taxation gains	Increased waste disposal charges
Planning gain	Local lobbying
Promoting sustainability/ biodiversity in local area	Stricter building control requirements on services
Reducing waste	Stricter planning controls
Reducing fossil fuel use	Nothing
Not considered relevant	Other
Other	Increased climate change levy

Table 5-6 Overall rankings

So very few respondents (41%) chose to complete this question it could be assumed that their retailer's future policy is not communicated to the consultants, or not in evidence in their current practices. Of those that did, there is some expectation of changing policies in the near future. It is interesting to note that family friendly and access provisions mostly are in place now. This may be as a result of new Part M legislation and Disability Discrimination act for disabled access and also that the customer has driven demand for these things. For instance parenting magazines often rate large stores on their toilet provision.

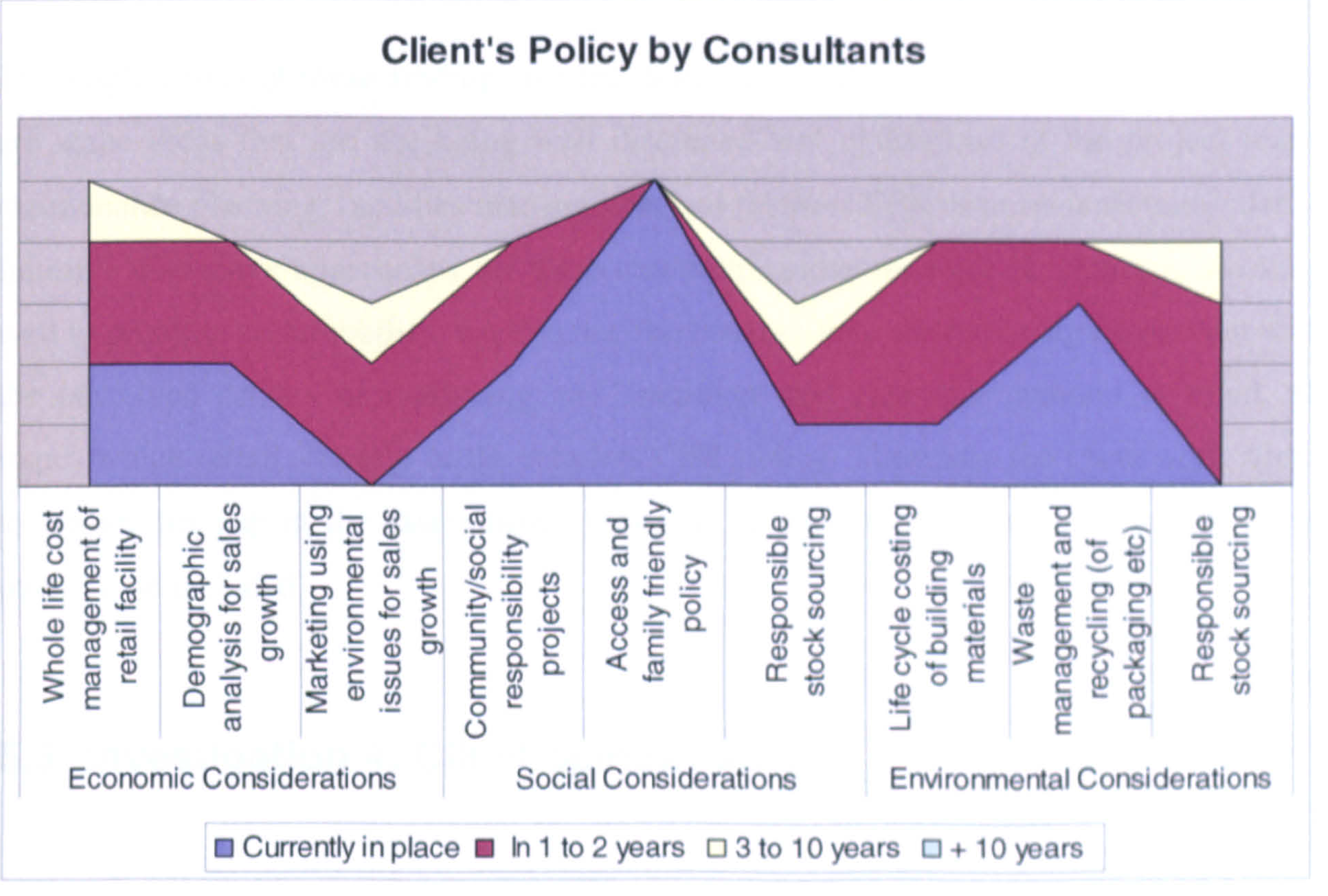


Figure 5-6 Client's policy by consultants

5.4.8 Findings

This exercise did not yield a high enough response to allow generalisations, but it did support themes on a number of issues;

1. Consultants would tend towards an "active" environmental policy
2. Most projects have a 5-10 year life cycle
3. Designers are unlikely to be aware of how maintenance will be managed
4. Intuitive analysis is the most common approach and it tends to occur in the design stages
5. Half of cases used standard details

6. Marketing is viewed as the prime reason for incorporating sustainability into store design
7. Employee demand followed by customer demand is expected to be the force which pushes sustainability issues further
8. Consultants have a limited knowledge of their retail clients CSR policy

The implications of these findings for the design methodology framework are that there are some areas that are not being well discussed and understood in the project team; maintenance planning, facilities management and retailers CSR requirements particularly. Intuitive discursive approaches for these communications may not be currently working well to promote sustainability, but this may be because they are not being carried out with the perceived drivers of marketing and employee and customer demand in mind, all issues which relate strongly to the retailers CSR policy. Therefore the framework needs to bridge this gap in the assessment of what is actually in the retailers brief and what ought to be included.

5.5 Investigation 4: Client opinion survey

5.5.1 Aim, objectives and anticipated outcomes

The aim of this investigation was to compare the response of retail clients to a similar set of questions as those posed to consultants. The objectives were;

1. To understand retailers' values, and expectations for sustainability in the future.
2. To balance the findings of the consultant's survey with comparable data from retailers.

Key data was based on a short self-completion questionnaire. The anticipated outcome was a demonstration of the level of understanding of client opinion.

5.5.2 Research tactics

This survey used a gathering of senior level Simons Group clients at a corporate event as a captive audience. The 40 representatives were invited to the event, but a random selection of 16 attended who were from a variety of organisations including eight retailers. The questionnaire was delivered following a presentation outlining the results of the consultant survey results, so in that respect the respondents were to a certain extent primed as to what professionals working for them or their competitors believed to be going on in the industry and as such may have sough to put those assumptions right.

The questionnaire used in investigation three was abridged to a two-page format in the hope that just including only the very significant questions from the consultant's opinion survey would help to increase the response rate. Some were completed and returned on the day, and following a reminder e-mail message 4 out of 16 were returned 25% being a reasonable response rate. As the resulting sample is so very small, it is no means suitable for meaningful statistical analysis. The high level position of the non-respondents prevented reminders to complete the questionnaire being effectively pursued by the author because no direct contact could be established or follow up interviews being carried out. The only respondent who identified themselves was a supermarket retailer, the other three were submitted anonymously. Results were complied using excel spreadsheets and calculations.

5.5.3 Results

The first question asked for a classification of the respondent's environmental policy, it would seem from this result that there is a tendency towards activity (Figure 5-7). Since the sample is so small, it is only suitable as an accumulation of the design priority rankings (Table 5-7 Clients design priorities). The remaining priorities were widely dispersed amongst the sample. These four could therefore be assumed to be at the forefront of the minds of most retailers. As a total group of priorities, it would seem that it is most advantageous to ascertain the priorities of the retailer for each new project or roll-out programme for the avoidance of doubt.

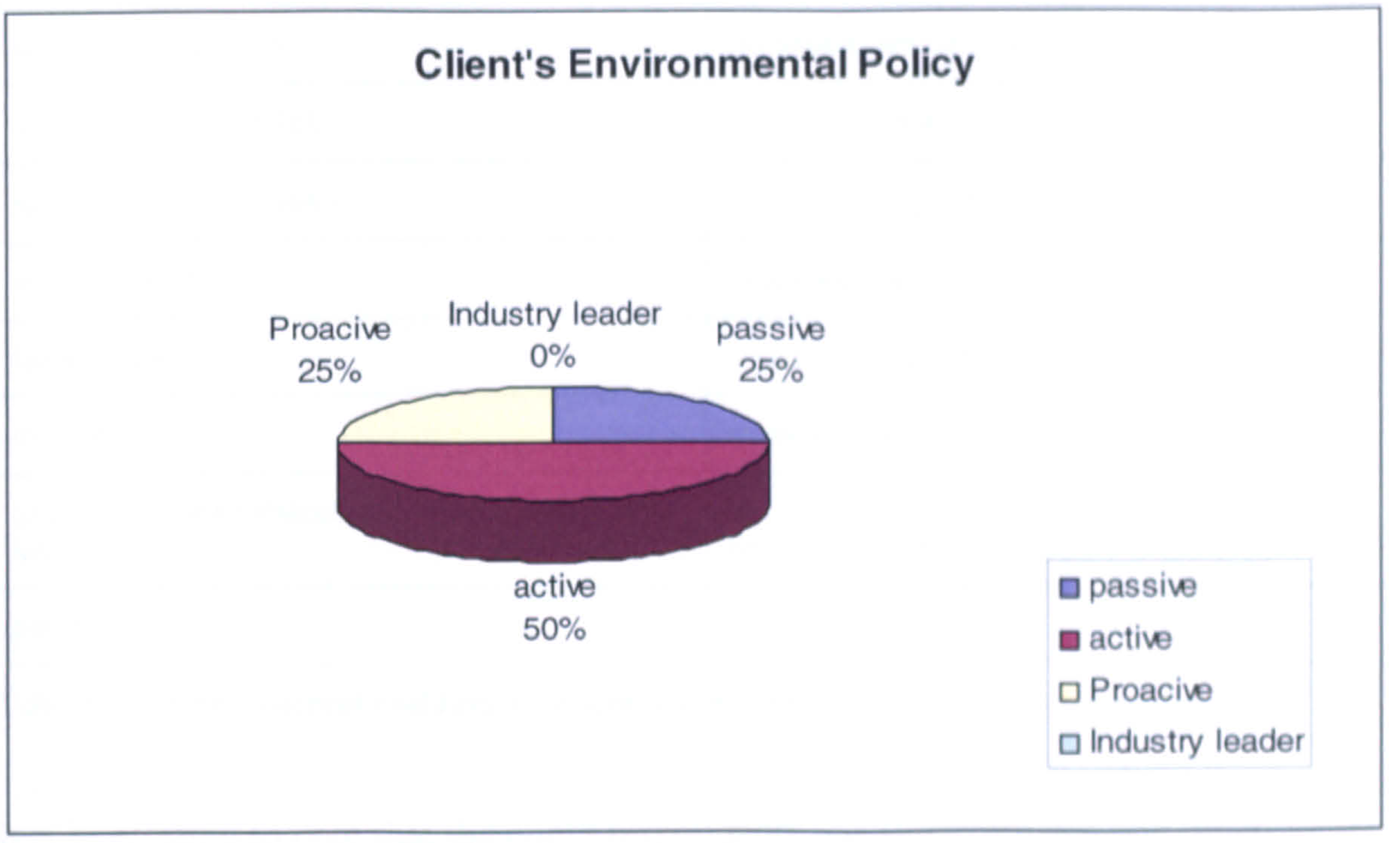


Figure 5-7 Clients environmental policy (client opinion survey)

1. Minimising capital cost
2. Maximising resale/rental value
3. Maximising turnover = linear metres of display
4. Maximising store layout efficiency
5. Image or brand repositioning
6. Minimising maintenance
7. Design impact
8. Layout flexibility and demountibility
9. Customer comfort
10. Store finish quality

Table 5-7 Clients design priorities

Now	Future
saving running costs	increased climate change levy/fuel costs
corporate responsibility	customer demand
reducing fossil fuel use =	stricter building controls
reducing waste =	increased waste disposal services
taxation gains	attractive tax incentives/grant available
marketing tool	employee demand =
promoting sustainability/biodiversity/amenity value locally =	stricter planning controls =
planning gain =	local lobbying

Table 5-8 Client's current and future sustainable design priorities

It is interesting to note that the client respondents put employee demand much lower that the consultants did. It is also interesting to note that fuel costs and building controls ranked so highly. One of the questionnaires was completed by a supermarket chain and this may have affected the result. That customer demand is high bears out the theory that the market will be a key driver in change towards more sustainable retail facilities. That planning controls figure so low in both the rankings might suggest that the current planning requirement for larger schemes to provide sustainability statements may be being treated by the construction industry as a lip-service or "green-wash", such that the statement is an irrelevance written only to mollify the planners without any real substance or integration into scheme design. Though this may seem a sweeping statement, it does help to support the need for a better method of analysis.

The parity between corporate responsibility and customer demand suggests that there is an awareness of the need to be open about their policy and that it is sought out by customers. Building control legislation is anticipated to be important in the future. This is reflected in the expectation of much tighter energy controls on construction sectors that have previously escaped much control with the introduction of Part L (2006). One of the respondents had not answered any of the following questions, stating that Corporate

Social Responsibility Policy was an unknown concept. This may be a cynical response or an oversight on the part of the question; assuming that such policy was a well known concept at the time of the survey. Three were however completed and shown similar results to those of the consultants views, but not surprisingly were able to better estimate the long-term expectations in policy.

As this was a small survey, it cannot fully represent the population, however, it does help to identify the problems that retailing presents to sustainable design. Any framework method will need to respond or link to individual Corporate Responsibility policy and be demonstrable to the customer as an aid to marketing and brand positioning against competitors. Social considerations are being considered first. Economic considerations are probably more important that environmental ones unless a strong business case for customer demand is present. As these are probably all linked in some way anyway, it would be recommended that the framework is integral to the design process to allow appreciation and consideration of the full range of issues.

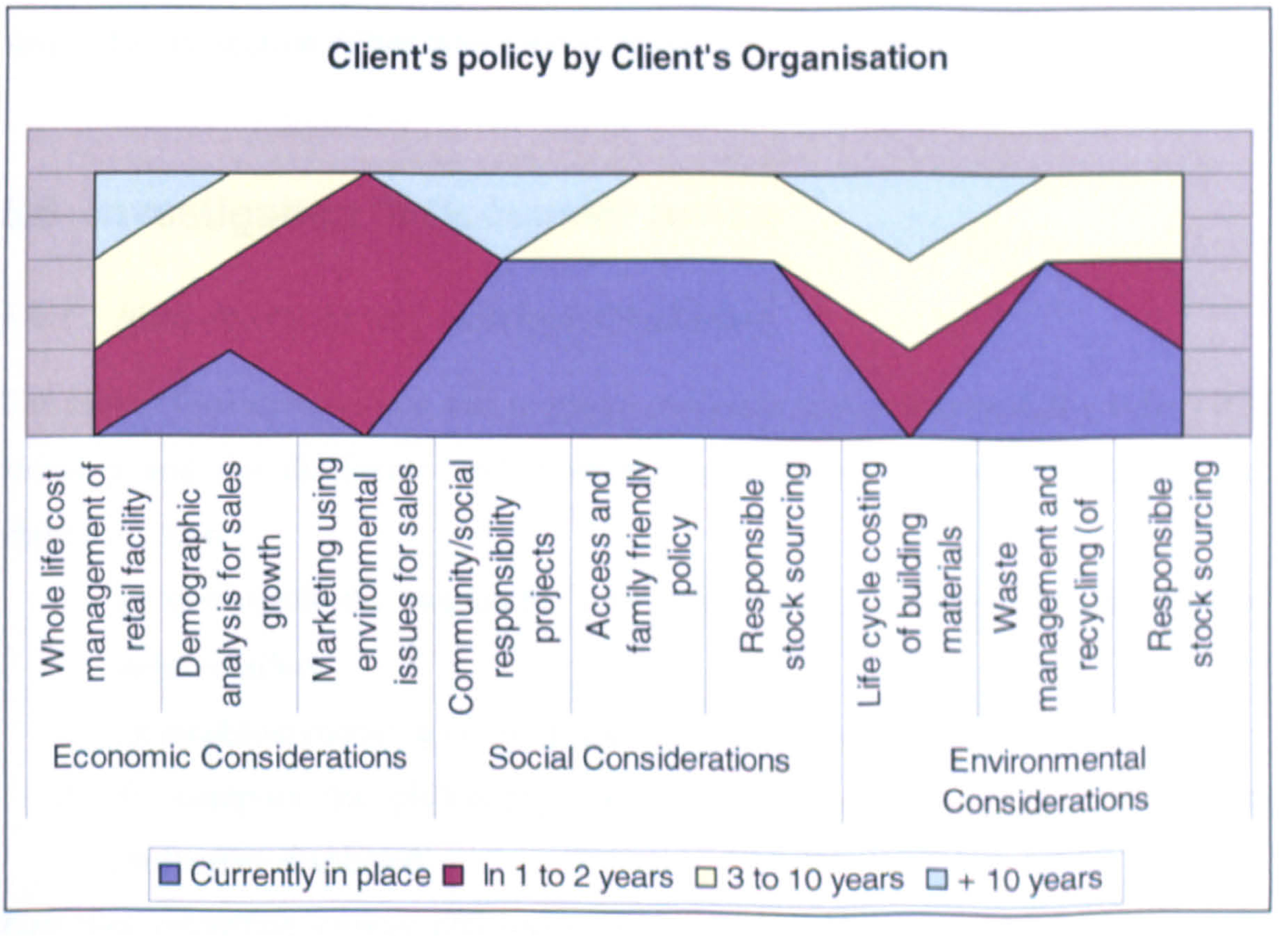


Figure 5-8 Clients CSR policy (client opinion survey)

5.5.4 Findings

A striking issue highlighted in a number of areas of this survey is that there is considerable limitation of information between the parties involved, this could be for a number of reasons, but it seems possible that these retailers believe they are protecting their interests and design teams are not obtaining sufficient briefing to understand their client's aspirations. This could be merely short term vision on the part of all parties or be caused by the fickle nature of future forecasting of retail business. If lack of communication is the reason, it is more likely to be an opportunity for change. The implication for the design methodology framework is to open up discussion for all parties in the procurement team to understand the retailer's intensions and motive and for the retailer to understand the threats that their development poses to sustainability in the wider the social and natural environment.

Both this survey and the consultant opinion survey were carried out in 2004 -2005, these results may already be somewhat out of date, but the research is limited to carrying out a single data collection rather than a longitudinal investigation.

5.6 Investigation 5: Document review

5.6.1 Aim, objectives and anticipated outcomes

The aim of this investigation was to gauge corporate social responsibility Policy (CSR) in retailing and the disclosure and promotion of information to the wider public. The objectives were;

1. To investigate the availability and content of CRS reports for a number of high street retailers.
2. To establish common or comparable performance criteria.
3. To compare the philosophy employed by the retailers and the futurity and profundity displayed.

Key data regarding energy efficiency, materials specification policy, or recycling was sought within web sites and the policy documentation available. The anticipated outcome was that whilst policy might be available and explicit regarding the products sold, it might be vague regarding the retail facilities of the particular company. It was anticipated that a pattern would develop as to the common performance criteria used by the retailers.

5.6.2 Research tactics

The top 20 UK retailers based were selected from a listing of the top 250 European retailers (by sales) published by Mintel for 2004-5. Ten out of the top twenty retailers were food based or had some element of food sales in their business, Seven sell clothing as their main business and six as part of a supermarket. Pharmacy, white goods, DIY and homewares are also represented. On this basis it is a fairly wide selection however as it is heavily dominated by the supermarkets, a number of smaller retailers have also been identified as leaders in their sectors and included in the study.

5.6.3 Published Corporate Social Responsibility Policy

At the outset of this research CSR was in its infancy, it has within a few years become very much the buzzword that describes the central ethical basis of business aims in all manner of sectors. Large industries that effect social and environmental issues have been quick to develop their policies. These policies are increasing entering the public domain through website publication and as such allow retail customers a powerful opportunity to force change in policy through where they choose to spend their money. Such accessibility, we might surmise, must ensure that companies are really living up to their claims.

This investigation intended to highlight the reality behind the policy for some key retailers and what this offers the customer by way of assurance and if possible identify specific examples of good practice from which to learn. The information has been sough from each company's web site. Other sources were in each case met with a referral to the information published on the sites.

5.6.4 Availability and content of CSR documentation

The analysis is for comments on energy use, material specification, water use, recycling of store waste, on the following subjective rankings;

Poor:	Little or no information
Basic:	Basic and clear statements
Fair:	Comprehensive and clear including basic data
Good:	Comprehensive detailed descriptions with data
Very good:	Detailed and in depth with
Excellent:	Detailed and in depth with rigorously presented data

There is no perceived benefit in ranking these on a cumulative or weighted ranking of as the appropriate ranking for performance should based on what is actually proposed for future action which is a very complex analysis to achieve. Comparison with competitors in the same market is however valid but the sample numbers are far too small to allow correlations to be established. Instead the BiTC CR Index (2006) is used, where retailers participate to show overall performance. The main aim of this investigation is to understand the profundity, futurity and philosophy of their initiatives and how they might relate to the briefing they are giving their design teams, rather than trying to quantify this information, specific statements and commitments are outlined as a literature review against the criteria developed in chapter 2.

Name of retailer	Website	Sustainability page	Downloadable report for 2005 or 2006	Specific information on facilities	BiTC CR retail sector Ranking
Tesco	<www.tesco.co.uk>	Basic	Good	Fair	3
Aldi	<www.aldi-stores.co.uk>	Poor	Poor	Poor	
Wal*Mart/Asda	<www.asda.co.uk>	Good/Good	Poor/Good	Basic/Good	
J Sainsbury	<www.sainsburys.co.uk>	Fair	Very good	Good	5
Morrisons	<www.morrisons.co.uk>	Basic	Basic	Poor	
Marks and Spencer	<www.marksandspencer.com>	Poor	Good	Poor	4
Kingfisher Group/B&Q	<www.kingfisher.co.uk>	Fair/Fair	Fair/Fair	Poor/Good	6
Dixons Group	<www.dixons.co.uk>	Fair	Basic	Basic	
Boots group	<www.boots.co.uk>	Excellent	Very Good	Very Good	1
Somerfield	<somerfield.co.uk>	Poor	Poor	Poor	8=
John Lewis Partnership	<www.johnlewis.com>	Basic	Good	Good	2
H&M	<www.hm.com>	Very Good	Good	Poor	
Co-op	<www.coop.co.uk>	Basic	Very good	Poor	10
Woolworths group	<www.woolworths.co.uk>	Basic	Very good	Good	8=
Next Group	<www.next.co.uk>	Fair	Very Good	Very Good	
Spar UK	<www.spar.co.uk>	Fair	Fair	Poor	
Arcadia Group Ltd	www.arcadiagroup.co.uk>	Fair	Poor	Poor	
Debenhams	<www.debenhams.com>	Poor	Poor	Poor	
Iceland	<www.iceland.co.uk>	Poor	Poor	Poor	
WHSmiths	www.whsmith.co.uk>	Good	Good	Good	7

Table 5-9 CSR Policy document review

Tesco are investing in micro-generation technologies for stores, aiming to reduce energy use by 50 percent in all stores by 2010 and implementing a green transport plan for distribution and staff. Investigating energy generation from food waste from aerobic gasification and should result in an initial plant in 2006. Claim that in 2006 71% of store waste will be recycled. Tesco's are actively encouraging customers to recycle packaging and bags by returning them to the store. In 2007 they plan to build the first ever supermarket constructed from entirely recycled materials. Tescos participate in the Dow Jones Sustainability index and FTSE4Good and are the BITC CR index sector leader in 2006.

Wal*Mart make a commitment to reduce energy use in stores by 25-30% by 2010 is a worldwide target, but this will only represent a passive level in the UK where Part L of the building regulations will require this in all new stores built from 2007. However, there is a strong drive towards on-site renewable micro-generation and using waste from stores to generate energy. Two operating examples in the US are well documented and include a number of other initiatives. Using the Asda site for the UK demonstrates a good level of information. And an active level or profundity to energy (commitment to reduce generally and continually improve with each new store built), waste management (a commitment to produce no landfill waste by 2010) green transport plan and social issues was demonstrated.

J Sainsbury have increased store energy efficiency by 20% since 1998 and intend to reduce that by a further 5% by 2008. They state that on average stores are operating at between 450 and 500kg CO_2/m^2 for 2006 which together represents 90% of the energy use of the company. They are taking an active and deterministic approach to saving energy in stores with facilities management training. They are also looking at changing refrigeration technology to have much less environmental impact. Composting and possibilities of anaerobic digestion are being investigated. Waste management and packaging reduction is also being tackled but the figures given are not clearly presented. A green transport plan is in operation with targets for vehicle economy and road miles reduction presented.

Marks and Spencer provides Information regarding energy use and waste management was about the business as a whole and transport and not at all related to stores. Some stores have had old flooring materials replaced with carbon neutral carpets and marmoluem and this will be an ongoing programme of replacement. No mention is made of future initiatives for new stores other than compliance with Part L 2006.

Work by the **Kingfisher Group** in the area of sustainability is led DIY store B&Q Twelve core values; greener supply chains, product stories, timber, chemicals, climate change, packaging, product disposal, transport, store waste, respect for the diversity of people, ethical trading, and store neighbourhoods are used to develop new stores. BREEAM assessment is used on all new stores with an aim to gain an excellent rating. Store efficiency averaged at $113.6kgCO_2/m^2$ in 2004 and has not reduced since, and is thought to be due to introduction of longer store opening hours.

The company has developed a well thought out policy for new store development and strategy for renewable energy such as roof mounted photovoltaic panels (in relation to developing and demonstrating the product range and wind turbines. They have set up a half hourly meter monitoring scheme for all stores to identify and rectify higher than average usage patterns.

B&Q are demonstrating an active to proactive approach and actively use customer feedback to review what they are doing as well as exploring technical opportunities. They are aware that the need to set an example for good sustainable construction to their customers, which is of course aided by the fact that their core business is in domestic building materials.

The **Dixons Group** have a strong commitment to improving energy efficiency in the appliances they sell, they also work at maintaining 80% recycled store packaging waste. They have an ongoing programme to save energy in store, but do not publish any factual information. On an international level they participate in FTSE 4 Good.

Boots provide excellent information regarding all their environmental policies and are part of the BiTC index and work with the Carbon Trust. They use kWh per £,000 turnover to analyse energy efficiency which although makes comparison with other stores difficult, does make the link between efficiency and turnover more relevant. As might be expected they have a great deal to say about their products but are not so informative about the stores themselves.

John Lewis and Waltrose use an alternative indicator of tonnes Co2 per £million sales to track progress in cutting emissions alongside government targets (10% reduction by 2010) this allows economic growth to continue providing efficiency increases proportionally. They have an average store energy usage of 52.4kWh/sqft figure (or 564kWh/m2) but note that increased trading hours has improved efficiency. They also state that their overall carbon emissions are down 5% on 2004-5. They intend to investigate renewable energy and are committed to exceeding Part L2006 in all new stores, but do not state the exact target. 37,000 visitors access their CSR pages each month, and as a Partnership they are very aware of the importance of the CSR messages they are giving to their customers.

The Co-operative Society have a large number of small supermarkets and a number of other businesses including home and fashion retail. They have tried to respond to the findings of the survey they commissioned Shopping with Attitude by looking at issues such as food labelling, local sourcing, GM free packaged meals, fair-trade produce and organic ranges. They have also looked at packaging, with bio-degradable fruit trays and carrier bags. They have a well rounded policy for social and environmental sustainability, and because any member of the public can join the society, the share or dividend represents their commitment to economic and social sustainability. They do not yet apply their principles in a public forum for the clothing and home wares part of their business.

More recently the group have switched all their stores to green electricity through an agreement with Scottish Power. Group chief executive Martin Beaumont said: "*Our* *customers and members expect us to take a leading position in tackling climate change impacts. By choosing this approach, we want our customers to benefit from a high-quality shopping experience, which also addresses much wider environmental issues. All businesses need to undoubtedly address their impacts on climate change, but for a member-owned co-operative, it's an imperative.*" (Kilgallen, 2006) Retail week 21 Aug 2006)

Woolworths helpfully state that they have 803 town centre stores averaging 8450sqft and 18 out-of-town stores averaging 51,300sqft. They are working with the Carbon Trust to reduce energy use in stores with lighting specification and switching. They have undergone a programme of installing better automatic door controls. They are dealing with store generated packaging waste by shipping it back to China in otherwise empty containers for processing there. They have also developed a reduced carbon distribution centre with renewable micro-generation capacity. Woolworths also participate in the BiTC CR Index.

Next have a building monitoring system in all new stores and are working through a programme of installation in older stores. This system monitors energy use, sending half hourly reports to head office and overriding switching. They are working on lighting and air-conditioning specification to reduce electrical load and are researching air source heat pumps. They state that wherever possible they use Forestry Stewardship Council (FSC) timer in store fitting (implying that some timber is uncontrolled). They state that they are finding it difficult to make comparable indicators for energy efficiency between annual reports due to changes in opening hours, weather conditions and new store development. Perhaps they would find this easier using Co2 emissions to sales as some other retailers have begun to do.

WHSmith have a target to reduce all stores energy use per square foot from 2004 levels by 5% in 2006. They have begun this process by carrying out an audit of the 40 stores with the highest consumption and putting a plan in place to manage energy, including giving each store manager direct accountability for the efficiency of their store.

Clothing retailer H&M are based in Sweden and have a strong policy regarding their products and distribution centres, no information is available regarding their stores. Debenhams state that they only accept timber products from sustainable and well managed sources (FSC grade). Surprisingly Somerfield have no mention of CSR policy on their website, despite having a good BiTC index.

5.6.5 Findings

Integration of CSR policy and specific aims and targets into the framework is a necessary part of establishing the brief. It is difficult to ascertain how well these strategies are being communicated to the design teams working on the future projects for the retailers in this investigation.

Profundity

It is interesting to note that many policies state a commitment to meet legislation on pollution and other environmental impacts which is directly comparable with a passive approach. Those that are taking an active or proactive approach are taking every opportunity to publicise their efforts (see Wal*Mart and B&Q) which leads them to appear as the industry leaders, however, they probably are not pursuing profundity at anywhere near the levels that could be taken for energy use reduction. This is very much a reflection on the need of retailers to remain economically sustainable, but also that a step by step approach is the most acceptable way to pursue reduced impact.

Futurity

Few retailers look beyond 2010 with their commitments and may do not even state clear targets for improvements for the following year. This suggests that the quantities that can be assigned to futurity in retail facilities are generally short, for instance this financial year, next financial year, 3-5 years and beyond 5 years. This level of *futurity* ties in with the replacement life cycles seen in most store designs.

Philosophy

Some retailers take a very people based business stance and this is very much evident in the social issues of their CSR policy reporting (local involvement schemes, charitable donations, family friendly policies and commitments to health, well being and staff satisfaction). This investigation did not set out to look specifically at these issues but they doe help to highlight the balance between these stakeholder issues, product supply issues (such as Organic produce and farming practices) that relate strongly to ecocentric philosophies and those issues relating to built form which tend to be technocentric in where information was available although it was interesting to note that none of the retailers had published figures related savings in running costs associated with saving energy despite the high probability that these savings will be proportionate. Those retailers that took a people biased or deterministic stance to their business tended to stress the importance of the involvement of their own staff, facilities management and customers in making initiatives such as energy saving and recycling work. This tendency was in evidence with the supermarkets Asda, Tesco and Sainsbury's, but was not immediately evident in all of the food retailers.

Performance criteria and targets

It can be seen that many give key target figures, such as reduction in carbon based energy use by percentage from a baseline $kgCO_2/m^2$ which are clear performance targets. Others are harder to establish and might require a more detailed briefing process being carried out requiring monitoring of existing stores or customer feedback research being carried out in order to develop targets for improvement. Finding a common indicator for energy efficiency to be used in reporting documents would be very useful for comparative purposes, but in the interests of design of facilities, the standard of kWh/m2 is probably the most useful for comparing different retailers' stores, but kgCo2/£ turnover is critical to demonstrate economic and environmental sustainability.

Corporate social responsibility has had an increasing profile in the last five years. Retailers that have an enlightened customer base will be under increasing pressure to compare their performance in these areas with their competitors to avid loss of trade and as employers. It should not be ignored that the shopping habits of the public are informed by the culture and education of the public and the level of design and social consciousness that is existent (Tucker, 2006). Successive generations of all stakeholders have received a greater degree of education towards environmental issues, in schools and in vocational and professional training.

5.7 Conclusion

The aim of this chapter was to explore current practices in retail architecture that could not be established from the literature review. It has demonstrated that existing environmental evaluation tools are not well used in the design of retail architecture and when they are used they tends to towards technocentric cost based methods. The design and construction of retail architecture would appear to be carried out with communication barriers in place between policy and briefing information. Corporate values and strategy regarding sustainability is not necessarily clear to consultants or wider stakeholders but it has been found that the retail industry is responding to the challenge of demonstrating sustainability in a variety of ways and levels of success. There is not a formalised methodology or performance criteria set being used other than BREEAM assessment and BiTC ranking in a small number of cases.

It was intended at the outset that this chapter would define performance indicators for the retail sector to respond to the prerequisites of sustainability. What has resulted has in fact shown that the retail sector is influenced by many factors and too varied to result in defined performance indicators. They would be better identified as part of the brief of each project. To identify a way to ensure this occurs is perhaps a prime driver in the development of a design methodology framework. The framework should however support and encourage some uniformity to allow the design and construction industries to compile performance indicators for a variety of project types and for retailers to develop longer term targets for improvement and in relation to external assessment (BREEAM ratings and BiTC Index rankings for instance cover very similar areas but at different levels of detail and emphasis).

Chapters 2 to 5 have followed a sequential transformative strategy to obtain a deeper understanding of the research problems through literature and investigations into practice. The next chapter applies this knowledge to the development a design methodology framework which will then go on to be tested in chapter 7.

6 Design Methodology Framework Development

The previous chapters have served to inform and develop criteria in the design of a methodology for sustainable design and construction in retail architecture. The aim of this chapter is to demonstrate the development of the framework from the initial conceptual proposal to a design methodology framework application. This aim will be met through the following objectives;

1. To establish the research strategy for the design methodology framework development.
2. To summarize the literature review and fieldwork, with a reiteration of the design criteria for the design methodology framework format and methodology.
3. To describe the conceptual proposal for a design methodology framework and how that meets the criteria for sustainability established in chapter 2.
4. To describe the process of developing the concept into a working proposal using strategy and tactics drawn from change theory.
5. To describe the working proposal design methodology framework and explain how it meets the criteria for sustainability.

These objectives will be met through a review of the findings of previous investigations and how these will inform the design methodology framework in the first section. The initial concept proposal will be described in the second section, and the iterative process will be followed as a narrative in the third section. The working proposal will be described in the concluding section.

6.1.1 Research Methodology

Coghlan & Brannick (2001) describe the process of implementation of change in practice in four stages;

1. Determine why there is a need for change
2. Establish the alternative outcomes if no change is made and if the change is made
3. Establish what present practice needs to change in order to achieve the desired future.

4. Determine how this change will be managed and monitored.

The need for change has been established through chapters 2 and 3 in that retail architecture has been slow to adopt a sustainable approach. Without any change, this sector of the UK service industry will be likely to bear the brunt of increasing taxation, energy prices and blame for the failure to address environmental impact, which will potentially be detrimental to business (fail to meet the requirements of economic sustainability that is core to its existence) and ultimately have a major impact on the employment opportunities currently provided. The preferred outcome is that retail architecture seeks to provide a positive and regenerative impact in environmental, social and economic terms. Chapters 4 and 5 have shown that there are a number of issues in current practice that might need to be addressed to effect this change. Communication between stakeholders, to establish the brief in terms of the retailers CSR policy and to develop strategy to meet that brief without posing a risk to sustainability would seem to be most essential. It is proposed that tackling this problem will create an atmosphere of clarity and openness which will bring forward many ideas and that will lead the procurement team towards a common goal of sustainability that is shared with their retailer client overarching the successful delivery of the retail facility in terms cost, programme, build quality and safety.

This methodology is based on the premise that the development of the design methodology framework is a design exercise in its self and that the system of enquiry is *emancipatory* (Groat and Wang 2002; Robson 2002; Coghlan and Brannick, 2001) in that it has the intention of initiating change in design practice and "*make a difference*" (Robson, 2002, p201) to the sustainability of retail architecture and draws strategy from *Participatory Action Research* that seeks to empower and liberate, in this case retailers and their building procurement teams from the traditions of non-sustainable design in retail architecture (O'Leary, 2004). In order to ensure research quality in this methodology, it is necessary to accept the transformational impulse and that principles of neutrality and objectivity cannot be adhered to (O'Leary, 2004). Instead there must be a logical response to the situation in making explicit the complexity and conflicts in the design process that must be overcome to progress towards sustainability in retail architecture. This is focused on the improvement of sustainable design practice, improving the understanding of sustainability by the whole project team, and an improvement in the actual social, environmental and economic impact of the retail facilities that are developed.

This process required a collaborative approach with others involved in the design and procurement of (retail) buildings and as these were real projects through situation in the sponsoring organisation. There is by necessity a need to accept that decision making and final direction is outside the power of the research and that the experiential learning strategy is a process to test the feasibility of the initial concept design framework methodology and improve the comprehensibility, functionality and applicability with successive iterations using collaborative responses and observations or *feedback loops* (Robson, 2002). It is important to note however that the design team collaborators are not the subject of the research, but that the design of the building is. However, the decisions and influence over the building design made by the procurement team that are significant in the outcome of the building design. Their input into the feedback loop makes their participation so important to the success of the collaboration.

The *Experiential Learning* process derived from Lewin's Change Theory (1942) and Kolb's Learning Model (1984) uses *Experience* and *Reflection* to lead to *Conceptualisation* and *Pragmatism* (Attherton (2005). In this research experience in the industry has provided pre-knowledge and reflexivity (May, 1998), and reflection has provided the body of knowledge gained from literature review and field investigations of chapter two to five (Coghlan and Brannick, 2001; O'Leary, 2004) to firstly establish design criteria. From a process of logical argumentation, an initial concept proposal was drawn to establish a concept proposal or conceptualisation; the series of iterative stages are shown on Table 6-1. The pragmatic stage of this experiential learning process will be explored in chapter 7.

Demonstrating rigour in this methodology is not straight forward, however Coghlan and Brannick (2001) set out that it is necessary to define how the iterative cycles are engaged, how the findings challenged and tested assumptions of meta-learning of Content, Process and Premise. How differing views of the same events were accessed and how grounding in scholarly theory can be demonstrated.

Kolb's Learning Model (1984)	Cycles in Action Research (O'Leary, 2004)	Experiential Learning (Coghlan & Brannick, 2001)	Research Design
Experience	Observe	Experience	Pre-knowledge of context
Reflection	Reflect	Reflect	Chapters 2-5
Conceptualisation	Plan	Interpretation	Concept proposal (IDEAS)
Pragmatism	Act	Take Action	Case study 1
Experience	Observe	Experience	Feedback
Reflection	Reflect	Reflect	Analysis
Conceptualisation	Plan	Interpretation	Design modification I
Pragmatism	Act	Take Action	Case study 2
Experience	Observe	Experience	feedback and analysis
Reflection	Reflect	Reflect	Design modification II
Conceptualisation	Plan	Interpretation	Case study 3
Pragmatism	Act	Take Action	Feedback and analysis
Experience	Observe	Experience	Design Modification III
Reflection	Reflect	Reflect	Feedback and analysis

Table 6-1 Iterative research design (change theory/learning model)

Coghlan and Brannick (2001) recommend that there is a point at which a decision must be made to stop this cycle of experiential learning and carry out the reporting stages to lead to broader implementation if the conclusion proves the proposed change is successful. Five iterations were possible within this time frame however some are ongoing beyond this research. This process is limited by the pressures of practitioner research described by Robson (2002); time, pace and programming of the case studies and the non-availability of retail case studies at the time at which the iterative process was carried out and lack of expertise in the collaborators, lack of confidence and hierarchical problems within the organisation. However these are counteracted by networking and support opportunities found within the sponsoring organisation and as a practitioner.

6.2 Summary of the Literature review

This section will reiterate the body of knowledge that have arisen out of the observation and reflection of literature review and fieldwork study and how these form the design criteria for the framework.

6.2.1 Architecture and the Environment

Chapter 2 aimed to establish a framework for the understanding of sustainability in the built environment. The following conclusions were drawn;
Environmental architecture exists as a wide spectrum of ideas and various levels of justification and a multitude of aesthetic schools. There are however three main philosophies, ecocentrism, determinism and technocentrism. These are aligned with the three aspects of environmental, social and economic sustainability. These philosophies are not exclusive, and have further dimensions of profundity and futurity. Whilst these criteria help to understand the application of sustainable design, they are an abstract concept which requires application.

6.2.2 The Retail Industry

The aim of Chapter 3 was to establish the significant characteristics of the retail industry and the impact these have on the buildings and interiors that are a result of retail stakeholder needs. Retail environments have historically been slow to adapt to the requirements of contemporary sustainability. However they are fast to respond to changes in the market. Change in the western consumerist value system is very slow and unlikely to adapt at a rate that will achieve sustainability without intervention of some kind (legislative or financial incentives). All stakeholders will respond to design quality and value for money of the retail offer. Consumer interest in environmental issues is increasingly significant in convenience goods but not significant in fashion retailing but there may be evidence that this is beginning to change. Retailers and their customers have varied and sometimes opposed expectations of the retail environment.

At the time of writing no legislation and incentives have proved to be ineffective to date however, the 2006 Part L of the building regulations will start to address energy use in the short term. External influences such as recession and fear of recession, terrorist threat, or un-seasonal weather variation are difficult to predict except in the very short term. The link between these threats and global social, economic and environment sustainability make the situation even difficult for retailers to predict. Retailers do not respond to long term financial and facilities management information as the immediate sale targets for the coming month or year are traditionally considered more crucial to business success. Economic (turnover and profit) evaluation is the primary performance indicator in the retail sector. The retailer's product and employment costs are always more significant to decision making than potential savings in running costs. Savings in construction costs are more likely to take precedence over projected savings in running costs.

- Energy management
- Low impact material selection
- Waste management
- Water management
- Flexibility and re-usability of internal components
- Promoting customer and staff well-being
- Direct provision of benefits to local stakeholders in terms of amenity and limitation of nuisance.
- Wider dissemination of policy, aims and objectives, targets and programme for improving sustainability of the business as whole and specific key areas of known poor performance.

Table 6-2 Sustainability considerations in retailing

Image and branding is very important in comparison goods and most especially for fashion and high street retail chains. Other influences such as advertising, endorsement, negative and positive publicity can be very powerful drivers for change. The accelerating use of CSR or CR reporting and positioning against rivals to gain consumer respect may become the most significant driver in long term consideration of sustainability. The primary aim of this research is to find a way to help retailers to reduce their overall environmental impact, increase social benefit and quality whilst balancing economic sustainability. In this way retailers would be able to create a virtuous circle of offering quality and value to their customers and shareholders whilst positively benefiting global supply chains, the local retail economy and hence maintaining good employment opportunities. Whist it can be recognised that the design team does not have a roe to play in instigating CSR policy, it is in a very strong position to extract the intent of the policy into the reality of the nature of the retail facility and development. What this might mean in term of actual retail architecture might be summarised as sustainability considerations (Table 6-2).

6.2.3 Environmental Evaluation

Chapter 4 outlined method for analysis and evaluation in the built environment and consider their suitability for use in the retail sector. It was found that there are a number of methods could be usefully applied, but they have different roles in identifying significance of sustainability in the design. When put in the context of retail environments, a uniquely short lifecycle in theory reduces the economic value, but increases the accuracy of WLC. Short life cycles increase material costs as a ratio of the whole building cost making CBA and LCA increasingly important. Social impact assessment, environmental impact assessment, and economic impact assessment should be used at the micro and macro scale of a project. These methods are complimentary and one method cannot exclusively meet the criteria established in chapter 2. The sustainability index for retail fit-out proposed using the Ding model modified to represent the most significant retail indicators may be applicable if conformity of measurement could be achieved.

- Carbon Dioxide emissions Carbon as an indicator Kg CO2/ m2 / year?
- Life cycle analysis and Impact of materials
- Whole life costing
- Waste volume
- Water use volume
- Turnover
- Social impact

Table 6-3 Key performance criteria for sustainability in retail architecture

However, the complexity of the calculation means that extracting sustainability to a single figure could leave large areas of consideration under explored. In conclusion it was shown that there are a number of key performance indicators that will demonstrate that a variety of needs are being met and inform building procurer decisions to improve the quality of retail environments. These should be carried out in an elemental approach to specific problems rather than an attempt to model the whole design project.

6.2.4 Current Practice in Retail Design

In chapter five, the assumptions made in the literature were supported by investigations into current practice at a wider level. The fieldwork survey of consultants supported the assertion that there has been limited interest and application of the issues of sustainability by the majority of retailers. It did however demonstrate that the most significant part of the procurement process is the design development stages when discussion and decision making that influence environmental and social performance are balanced against economic performance. This would suggest that this is the key stage to target for applying the framework. The short programme periods and limited budgets appear to limit any further analysis except at the value engineering stage where any significant elements may be deemed superfluous and be omitted. These problems are further heightened by the typical procurement methods and contracts used. Lifecycle length was demonstrated to be typically short in comparison with other building types making any financial discounting methodology unsuitable.

CSR policy and the application at store development would appear to be an emerging field that has potential for further development of sustainability planning and dissemination into the public realm. It is apparent that the issues that are being explored by retailers relate more to the social aspects of supply of goods and human rights in their supplier economies and to human resources development of their employees. Reportage of overall energy use is often given, but analysis or active energy reduction programmes tend to consider offices and distribution facilities rather that the actual stores. This may suggest that the trade off between primary energy costs against the anticipated affect on sales has either not been fully considered or is assumed to be too great a risk. Corporate responsibility is increasingly reporting on the energy and waste management aspects of businesses as a whole, but there are limited changes to project briefing information to respond to the reports and help to reach targets for the retail facilities that form part of the overall businesses. There may also be a link between incremental legislative changes, and business competition in the increase and change of standards in briefing.

These findings support the premise that the earlier in the design process that sustainability is considered, the more potential can be embodied in the design. This is traditionally seen as the briefing process, whereby the building procurer develops a brief from previous experience and known parameters, or the design consultant extracts the brief from less well defined information. It could be seen that the problems experienced are related to briefing incoherency or lack of discussion of the issues. Construction industry professionals are failing to address sustainability issues in these projects because of the constraints of time and budget and insufficient briefing for sustainability and building procurers have been supporting this pattern because there is no industry standard, no real incentive and little evidence that existing analysis methods are effective.

1. Time scale and budget constraints
2. Procurement method and concept/implementation design process
3. Defining adequate performance or sustainability indicators
4. Avoidance of philosophical imbalance or interest solely in one of the aspects of sustainability (economic, social or environmental)
5. Project scale and scope
6. Retailer design priorities
7. Legislative requirements and incentives

Table 6-4 Key factors in implementation of sustainability in retail architecture.

In summary, economic sustainability is critical to the performance of the retail industry. The following key factors are highlighted as crucial considerations;

The building procurer will generally require that an environmental approach does not incur additional cost. This requires good design and design integration. Inversely the retailer does not want to be exposed to future risk arising from anticipated changes in legislation, the economy. The consultants play a secondary role, however it is apparent that without a clear statement of environmental intent, the design team and contractor cannot be cognisant to disparate attempts towards environmentalism by individuals within the team. The building procurer must be enlightened and determined to ensure that environmental aims are not designed out by value engineering. The personal enthusiasm of individuals and their companies are the only assurance of environmentally benign behaviour. In the meantime, it must be remembered that each party is a business with an interest in profit and future workload with various and conflicting managerial forces. It is important that any environmental decision support model responds to these challenges.

Lack of clear performance indicators and monitoring methods makes analysis and comparison difficult. Bringing a clear set of sustainability performance indicators to the fore in briefing and discussion in the design process

Legislation and fiscal measures can provide an incentive to the building procurer. Grants and tax relief for environmental technologies have a major role to play in encouraging development. Planning Guidance and legislation are valuable tools for government intervention in less sustainable practices. These must be continually re-evaluated to prevent exclusivity. However as these externalities are difficult to forecast beyond a few years they are difficult to utilise in time based methodology such as WLC or decision making for energy strategies.

6.3 Framework Development Criteria

Criteria have been established in the first part of this chapter, and they form the brief for the design of the framework proposal. Therefore at each stage of development, the proposal must be checked against the required list of attributes. The following matrix represents the appraisal criteria for the framework proposal.

It is intended that the outcome of this design research is a working proposal design methodology framework to allow procedure to develop towards inclusion of the methodology into practice.

1. Demonstrate philosophical breadth – allow the tackling of sustainability issues from any philosophy not limited to only issues and solutions from one section of the spectrum and therefore demonstrate a balanced approach.
2. Demonstrate levels of profundity – to allow stakeholders to distinguish between just slightly better than standard proposals against the most cutting edge technology or radical ideas and the consider the benefits of a range of proposals and how conflicting issues interact.
3. Demonstrate levels of futurity – to allow an understanding of how far ahead the proposal can be considered to be relevant or when it might need to be readdressed.
4. Flexibility – to suit any type or scale of project regardless of stated environmental policy.
5. Transferability – to encourage the comprehension of the relationship between design issues and CSR policy.
6. Balance – to allow a tendency towards one philosophical approach to be highlighted and reappraised.
7. Legibility – to be accessible to all stakeholders without significant knowledge or training required.
8. Accessibility - to support the discursive intuitive method of analysis that that is most commonly used in design decision making for sustainability.
9. Continuity – to be manageable after design consultants have completed their scope of works to allow it's use to continue through facilities management to the change life stage.
10. Consequence- to be taken seriously and not just as a public relations exercise or addendum to planning applications.
11. Equivalence - To support the use of report based assessments used by different members of the design team to address specific issues often pertinent to planning conditions (Noise Impact, Archaeology etc).
12. Legibility- the principles and conceptual framework must be obvious and self-explanatory without the need for specialist knowledge
13. Accountability – to have defined performance indicators to allow comparison between proposals, tenders or between stores.
14. Transferable and comparable data generation to ensure the framework is compatible with legislative requirements in building regulations and planning.

15. Rigour and hence cross-disciplinary credibility must be ensured through the methodology.
16. Simplicity – because the time and budget limitations would preclude anything else on all but the largest projects.
17. Auditability – The process must be recorded and treated as a record document subject to the professional and quality guidelines that design consultants are governed by. This should be a long term management strategy of the sustainability of the project that stays with it through its lifecycle. This should also enhance data available to CR reporting.
18. Conventionality – Using performance indicators that are commonly available, understood and calculated.

In the interests of transparency and legibility, it would not seem appropriate to develop a "black box" analysis method as this will reduce the involvement of all stakeholders and design team members. It must also be simplistic enough for all stakeholders to understand without the need for specialist training or knowledge. It needs to demonstrate an audit trail of how the design has developed from concept through to implementation on site, and identify when design changes have had an impact on the sustainability of a project. The method must also allow comparison with other projects and allow demonstration of key targets, such as those set by BRE or potentially by building regulations revisions in the near future.

It is important that the method is integral to the design process and not an add-on provided by an outside consultant. This is important to link CSR or CR policy in a strategic manner to the brief and there on to the design, construction and management of the retail facility. The best aspects of all of these methods have potential to improve sustainability in retail projects, but the application must be aware of the limitations of the individual investment of time and cost appropriate to each project to simplify the effort without reducing the effectively of a proposed framework The next chapter will propose the framework based on the findings of this and the previous chapters and demonstrate its application through development.

This consideration of other methods of analysis has demonstrated that what is significant for an evaluation method is how the information is presented and the concept behind why it is needed. Evaluating buildings could be done in the same manner; for achievement of performance as in benchmarking, for strengths and weaknesses as in profiling or for long-term strategy planning as in risk assessment.

What needs to be understood here is whether the evaluation for retail analysis need to analyse the design process and briefing, or profile/benchmark the existing building or consider the long term strategy as in risk assessment. It could be argued that all these things are necessary different times, criteria weighting at the inception of the project, profiling during the design development with benchmarking before construction commences and also in-use. The whole process should be overviewed in a strategic manner.

Investigations in Chapter 5 have demonstrated that there is some discrepancy between what a retailer sees as the key design priorities of retail projects and what is understood by consultants. Other stakeholders such as staff and customers are rarely involved in store development. Unlike schools and hospitals, customers have a lot of choice about where they shop so retailers are naturally aiming to exploit this by competition with similar brands and have a fairly good idea of what their customer base is expecting of them. Therefore retailers would argue that questioning of customers as stakeholders is unnecessary, as they can clearly vote with their feet, however, this form of market research could also be seen as a very powerful tool for understanding stakeholder evaluation of both product and service provision. There is some value in selecting key issues to be weighted by the retailer, and these re-evaluated during the course of a project or string of similar projects. It is possible that intuitive weighting is carried out by consultants based on their own understanding of a brand. To clarify to all parties what is expected at the outset would seem to be good practice. This could be carried out as a simple listing or ordering of statements without the need for complex matrices.

To keep decision support models current with external factors requires continual management of weightings and time related evaluation that could affect design development and facility management in the long term. It is difficult to reconcile this paradox between very critical factors and unmanageable rates of change. The problem would remain that employees or a representative of potential employees should be involved in this process (Human Resources representative in a larger company perhaps) It could be argued that in smaller scale retailing, the decision maker in the procurement organisation has very often been an employee at an earlier stage in their career and has experience of the problems and issues involving staff. Some larger stores encourage management and store development staff to experience hands-on working on the sales floor at peak periods.

6.4 Framework Design Conceptualisation

This section sets out the theoretical basis for the framework methodology.

6.4.1 Content

The findings of the construction professionals' survey in chapter 5 supported two themes; firstly, that the main period for analysis was in the design stages, and secondly that it was predominantly intuitive and discursive in nature. Further literature research outlined in chapter 4 confirmed that the application of software tools for a variety of analysis methods are limited by comparable data availability, materials options and general flexibility and applicability to the retail situation. Although this situation is continually improving as software and website packages are used and developed, each method of calculation is time consuming and needs to be understood in context. Whilst all the individual calculations and resulting figures are useful, they are disconnected information to stakeholders unless they can be compared against best practice examples or other similar projects. Despite some evidence of patterns for retail categories and in roll-out schemes, all retail projects have some unique elements such as site microclimate or shell construction, all retailers have unique criteria. Time (and budget) constraints prevent over-complicated modelling of all but the largest schemes; elemental approaches are preferable, concentrating efforts on the most significant factors. The question remains how to pull together all the best methods of analysis into one system to consider the multiplicity of issues that must be considered. It is proposed that a strategic document can provide the overall scope of the project and greater detail can be included as the scale of a project dictates.

Climate Change Levy has not had a major impact on retail design, with these costs being passed on the customer. The impact of UK Approved Documents L2A and L2B 2006 (Davis Langdon, 2005) should help retailers to accept the need to be more efficient and responsible about energy use. Setting regulatory energy performance targets for new and existing buildings to be reviewed every five years, although these are not yet published for retail buildings, will provide a baseline for these calculations or using carbon emissions calculation methodologies Simple Building Evaluation Method (iSBEM) instead of elemental methods. Certification and independent testing of plant will also be required. The introduction of a requirement for log books to help building users manage their facility more effectively is also recommended. This may replace the operations and maintenance (O&M) manual that has been in existence for some time. This also relates to the information contained in the Health and Safety File and would combine this large amount of often very technical information into a more useful format for the facility manager. The impact of these regulations has yet to be seen and cannot be fully realised until the first retail projects are subject to them. The regulations are expected to require greater technical input for services in small projects typical of the mall and high street shop fit-out that have preciously depended on maintenance of existing air-handling systems and concept lighting schemes. The responsibility for energy calculations in these cases may be directed at the supply designers, which could help to accelerate the development of better low energy products for the retail sector. Undoubtedly these regulations will have an affect on energy costs for retail facilities, however, for retailers, the overheads of staff costs are very significant and the balance with sales profit. Energy costs are increasing more rapidly than had been anticipated by the DTI (2006) in the last ten years, this may make renewable options more cost effective than previously calculated, but more importantly will contribute a greater level of overheads to retail business.

6.4.2 Process

The framework requires that the existing skills of the existing project procurement team are utilised as the introduction of an outside party to provide facilitation is costly and without involvement in the project from an early stage an external consultant has limited understanding of design development and decision making from the outset of the project.

It is important that the value of discussion and rhetoric in design development are not underestimated. These are the key ways that society has managed ethical issues and come to agreement on how difficult matters in society can best be resolved. Holm (2006) suggests that values, both societal and individual are at the heart of the design process, and it is a combination of knowledge base and ethics that form the design response to a brief. Grant et al (1993) recommends the heuristic nature of true design as the solving of real world problems through conceptualisation without recourse to automated process. Design is therefore a meta theory with many sub-theories and knowledge bases where contribution must be from multiple stakeholders. Debate should be welcome around the project design and procurement team that also includes the user groups and facilities management teams as much as is possible. The ethical argument is how to reduce the possible negative impact of the project on its environment whilst managing the positive impact it might have on social and economic fronts. This process is effectively managing risks.

6.4.3 Sustainability Risk

Applying the methodology of risk assessment and mitigation to sustainability should provide a direct reflection of the idea of maintaining sustainability as the same as maintaining health and safety both on the building site as is currently carried out in the assessment of risk in the short term from noisome construction practices, but also in the longer term for the project design life and decommissioning. The principle of sustainability and impacts of not carrying out identified mitigating actions could be treated in this way. It is important to note that construction risk analysis and management has primarily been concerned with the reduction of risks associated with a project failing to be delivered to programme, budget and to a standard of quality required by the procuring agency (Dallas, 2006; Smith, N.J., 1998), here the concept is that the risks posed by the project to sustainability are the subject of the analysis.

This proposed method does not render any reliable statistical comparators and for this reason removes the comparability of projects but would be situated in the time frame of the project and the issues and risks considered important at the time. This method is subject to the issues of ranking the risks for comparative importance (Hester et al,

1998) and unavoidably some risks will have a greater emphasis than others due to the historical situation, locality and funding constraints. Participation of a wide range of professionals in the process is beneficial as it ensures that language and meaning between sectors is universalised, benefits of wide rage of experience are gained and because it encourages innovative thinking on every project no matter how small. It is simple and straightforward to manage and within the capabilities of all stakeholders to understand although the perception of relative importance of particular environmental issues must be ranked or listed in some way.

Calow (1998) describes a framework for sustainable product design and manufacture using a risk based approach. Research by White (2004) suggests that climate change poses a risk to the built environment and using risk analysis as a framework will help to mitigate the effects of climate change on the urban environment. White recommends using monitoring, prediction, data management and communication as the basis of an urban risk management strategy. This strategy is concerned with risks to buildings caused by natural hazards (that are assumed to be due to climate change). The concept being proposed by the Design Methodology Framework is that the building poses a risk to ongoing environmental, social or economic sustainability on a micro or macro scale. Prediction of natural hazards as described by White may also have an impact on the design of any building but this is subsidiary to the acknowledgement that the building is a contributor to the climate change problem by emission of carbon dioxide through fossil fuel use.

The principle of assessing and managing risk is a simple and readily understood format, it has the advantage of being accessible, editable by stakeholders whilst still capturable at any project stage, transparent and honest. If we see the management of sustainability by the procurement team as an exercise in responsible environmental, social and economic policy, it is reasonable to accept that the project team is capable of managing the process as a straightforward document. The document is an aid to definition for various aspects of the project, it supports the intuitive discursive method that is familiar and can be maintained into the use and demolition phases of a project as a document on electronic file or paper operations and maintenance file. This format has been translated into design risk management process, to facilitate the identification of and clarifying steps taken to deal with risk associated with additional and abortive work by consultants. It also keeps a record of what design issues have yet to be fully resolved. The very basic principle is to identify a risk and then document what steps can be taken to mitigate it. The more complex consideration is whether the risks should be considered in a quantitative manner and/or ranked in a comparative manner.

Dallas (2006, p34) states that;

"...risk management can be quite straightforward, but requires leadership, buy-in from the project team and rigour in its application."

It is proposed that this format is appropriate to a strategic analysis framework for the consideration of economic, social and environmental risk to sustainability posed by the construction and use of project into a tabulated format that could be easily understood and shared by all stakeholders. Using the concept of risk to the environment as a subjective, unit of measure in the same way that risk to life and injury is used in a Health and Safety plan under UK law. It could be argued that looking at the issues of sustainability in this negative manner is radical, as it opposes the how sustainable design solutions are looked on as positive contributions. Instead it treats the risk posed by failure to deal with a particular problem, for example high electricity use could contribute to fossil fuel running out, global warming (associated with flooding, crop failure etc), and have an increasing cost in use to the end-user as tax, levies and scarcity affect future prices. Therefore it would be both sensible and ethical to try to mitigate this risk.

As a hypothesis it is proposed that a strategic level risk to analysis that allows

1. Statement of the risks to sustainability posed by the proposed project (ranked and or quantified)
2. Determination of the Philosophical standpoint (ecocentic/technocentric) problem and the philosophy of the action(s) used to mitigate the risk
3. Determination of the futurity of mitigating actions
4. Determination of the profundity of mitigating actions
5. Statement of where the responsibility lies for ensuring the actions are carried out, maintained or documented.

6. Elemental level testing using existing methods and software packages to be included as required by project specifics
7. Accountable, accessible and legible to all stakeholders
8. Opportunities for demonstrating improvements in performance in a comparable and visual format.

Managing this format would be the responsibility of a member of the project team, it would need to be a person central to the leading of meetings and raising sustainability issues on the agenda and recording of meeting minutes and to the creation of scope of work or *Client Requirements* documents. This role is normally carried out by a project manager or architect.

Challenging conventional passive responses to sustainability issues can only be agreed by the building procurer supported by their own policy for CR and the level of profundity that it calls for. Some design aspects naturally will be more challenging than others.

6.4.4 Applicability to Retail Projects

This format is aimed at being applicable to any client type. It is assumed that the consultants along with the client know a great deal about the particular requirements and limitations of their projects though the brief and additionally through experience and repeat business. What sets this structure apart from many other methods is that it is comparatively quick to perform which should suit the programme constraints on retail project teams. It allows the client to select from a range of options in the full knowledge that they are ranked for their level of responsibility. It allows a multi-tiered client body to share complex discussions from meetings in a tabulated form that reduces the risk of biased or confused reporting. It does not require the appointment of a specialist assessor or consultant to deal with the management of the structure (saving on fees) and should be well within the ken of project managers and architects to lead without needing specialist knowledge of environmental design.

6.4.5 Limitations of the initial proposals

The main problem associated with this matrix-based analysis is that it is not referred to once completed. The architect (under the Sustainable Futures Group of the RIBA-2006) has a professional duty by obligation to consider sustainability although this is currently inadequately monitored or implemented. Health and safety information can be repeat copied for projects without proper analysis, this is bad practice and is normally discouraged, and the fear of litigation ensures a level of responsibility in that field of risk management. Likewise, in the management of programme and budget risks the client imposes a controlling force. The industry is still waiting for the force to arise that makes socio-economic environmentalism a similar consideration in professional terms. This can only come from CR policy pressure to exceed previous performance. In order to develop the framework into a workable solution through design research an initial framework was developed following the criteria set out in chapter 7.

In order to look more closely at the mechanics of the decision making process and how a tool can fit into this, it is proposed that a series of live retail projects will be followed in detail to further illuminate the issues and processes surrounding environmental decision making through the project life stages. These projects will be directly accessible through the writer's employment or work of other architectural practices or contractors already known to the writer through business contacts and will remain confidential due to the sensitive nature of the client relationship. Primary sources of information will be used including drawings, meeting minutes and correspondence and also in-depth interviews of stakeholders, site visits and possibly observation of significant meetings. An important aspect of the research will be the possibility of interviewing key design team members at the point at which significant issues arise and the course of action is most clearly apparent. The assertion being that provision of information (for example via a modeling tool) to the decision makers at this stage is critical to the outcome of the design and its influence on the ultimate level of sustainability of the facility as a whole. At this stage it is not proposed to intervene in decision-making, it is purely and observational study.

The focus of the studies will be to identify the similarities and differences between the cases; looking at developer and landlord issues, project team and client working patterns, decision making and methods of analysis used, These will be considered in three areas, economic factors such as use of value engineering, imposition of social factors such as Disability discrimination act, planning and local heritage constraints and environmental issues such as construction materials and site waste management.

6.5 Design Methodology Framework

This section describes the iterative process used to develop the conceptual proposal into a working proposal. This used four live projects as shown in Figure 6-1 Experiential Learning Iterative Research Plan.

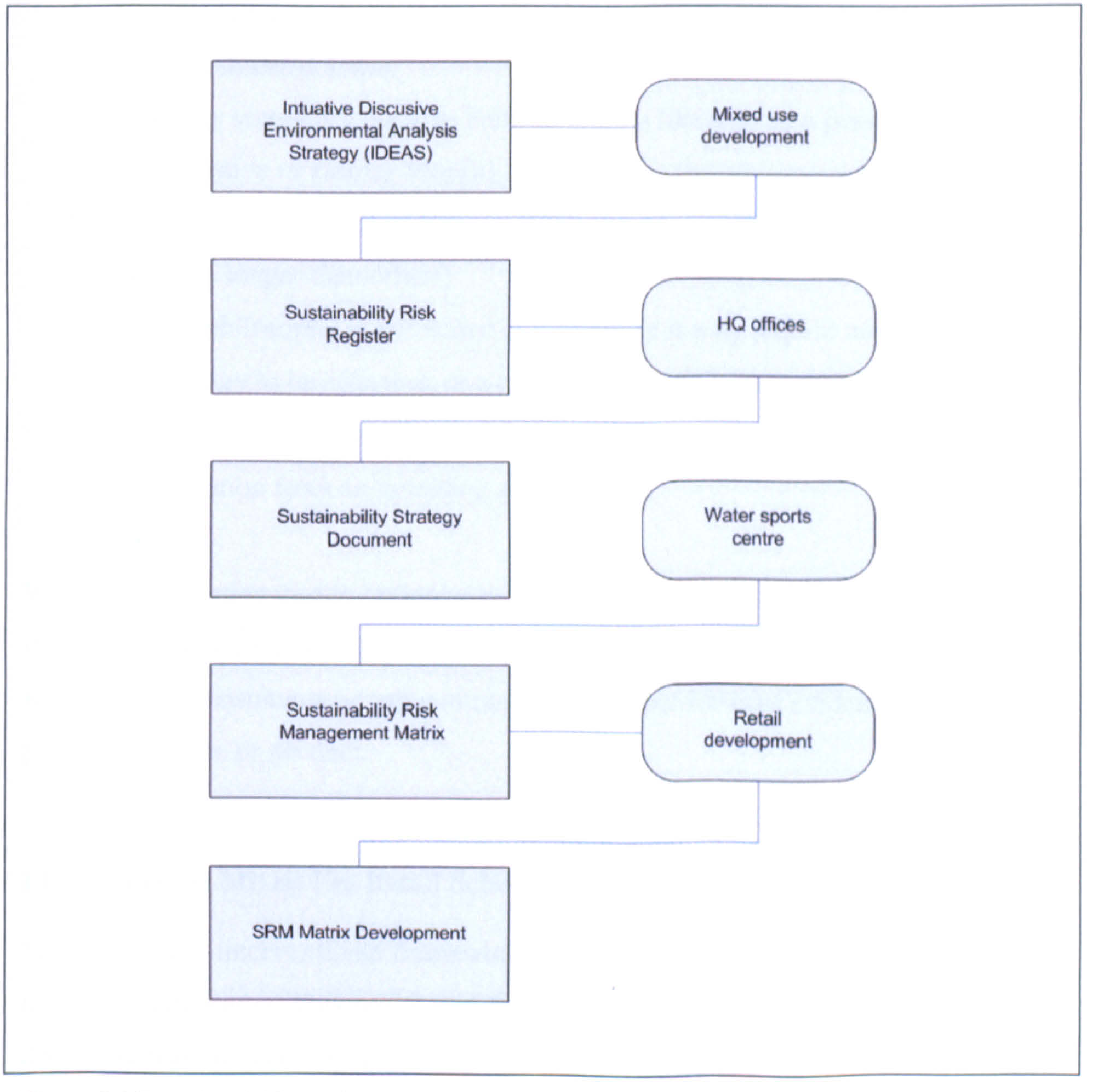


Figure 6-1 Experiential Learning Iterative Research Plan

6.5.1 Proposal 1: Intuitive Discursive Environmental Analysis Strategy (IDEAS)

An initial sustainability risk register format was developed on an excel spreadsheet.

1. Identify risk to sustainability
2. Assess the likelihood of the risk occurring (this is very subjective and affected by contemporary media as well as personal feelings of team members)
3. Identify outcome of risk
4. Identify any other related issues
5. Develop a range of alternative actions based on Profundity
6. Identify selected action
7. Note any secondary positive benefits (this is likely to be a positive payback, tax incentive or similar benefit)
8. Define expected level of futurity (each risk has a different timescale some may be much longer than others)
9. Define philosophy of the action (for example it may require new or special technology to be effective, or a change in human behaviour)
10. Identify measurement of success (this may be a design criterion or qualification from an assessing authority)

Whilst documenting design options put forward, the structure could be saved at each stage and appended to meeting minutes to back up decisions by team members and when various consultants or sub-contractors might put forward evidence of a particular system or product.

Live Project 1: Mixed Use Retail Scheme

This initial non-interventional framework was used as part of a brochure submission to potential investors. This initial trial demonstrated that the information held on the document was subject to being manipulated and used selectively. Had a facilitator or sustainability risk co-ordinator been appointed this may have not been so likely? It is also possible that use of the document in meeting minutes at early stages may have increased its profile.

The project continued into detailed design development and a strategy document was required for the planning allowing the framework to be used again.

IDEAS											
Project:	**Prototype Supermarket Scheme**		**1**								
Risk to Sustainability	**Likelihood**	**Risk**	**Issues related or affected**	**A Minimum solution**	**B Alternative solution**	**C Maximum solution**	**Selected solution**	**Positive benefit of selected solution**	**Futurity (how far ahead can we reasonable plan for?)**	**Philosophy (is the success of the selected solution dependent on technology, human action or environment ?)**	**Risk fully mitigated?**
Increased Co2 output	high (supermarket will need high refrigeration and servicing loads)	global warming	Future potential for much more efficient systems, solar gain and fabric losses (BRegs part L)	best efficiency M&E equipment selection	Wind powered electricity/photovoltaic	CHP plant using carbon neutral fuel source, i.e. bio-diesel, wood chips from locally derived source. Special arrangements with other uses on site of heat and energy	C	potential for sale of over-supply electricity to grid. Waste heat can be used to keep ramps etc free of ice. Grants available at present time.	20-40 years?	technology	controlled for major users, but difficult to control domestic use if not leased

Energy loss through fabric	medium	global warming and carbon emissions from non-sustainable energy sources		build to building regs for fabric and air tightness with good practice and quality workmanship	exceed standards(may have negative impact on the use of materials against CO2 saved)		A		envelope life 60 years	technology	balanced against losses
Increased water consumption	medium	resource depletion		limit supply where possible, ie taps and cisterns etc	collected water for WC's	composting WC's	B		20-40 years	technology	partly
Increased rainwater run-off	medium	local flooding and watercourse pollution		storm storage	collected grey water for WC flushing	sedum roofing			80 years	technology/environmental	depends on future rainfall characteristics
un-sustainable sourced materials	high	loss of habitat and environmental degradation		specified for significant materials only (i.e. sustainable timber)	ban significant materials and impose fines for use	specify controlled list of allowable materials		developer could control fit-out by incoming tenants.	20-80 years	human action	cannot readily control any work done post contract
Waste production to landfill	high			Recycle cardboard, plastics compactors, metals and glass bins	A and reduce and biodegradable packaging	A,B and Provide re-usable or returnable packaging		payback on plastics and cardboard if managed by supermarket. Tax savings	ten years?	human action	% will increase with education/promotion

rapid material replace ment cycles	high	waste production and resource depletion	repair and maintenance cost to tenants and landlords	apply WLC or similar calculation strategy in selection of specific elements, materials and finishes	accept low maintenance construction only				20-80 years	technology	
Short term construction impact	high	noise traffic and pollution		health and safety plan	phased construction		A&B		construction programme	technical/hum an action	constant manageme nt will be required by planning supervisors and contractors
Loss of trade to small and locally sourced town centre grocers/but chers etc	high	Town centre degradation	local producers loss of market and potential for protest against supermarket	Enhanced pedestrian linkages			A			human	responsibilit y of supermarke t
Increased traffic for deliveries		noise, congestion and emissions		supermarket travel plan	locally imposed management (segregation)		A&B			human	
Increased shopping traffic		noise, congestion and emissions	spaces for the clinic always no-cost and available	supermarket travel plan	locally imposed management (segregation)					human	

Inflexible structures (supermarket)	high (would be difficult for this type of building to be converted to use other than retail)	vacancy or early demolition							25 year lease?		
Inflexible structures (other shops)	medium (if awkward plan forms are avoided)	vacancy or early demolition							10 year lease?		
Inflexible structures (housing and offices)	medium (if awkward plan forms are avoided)	vacancy or early demolition	need to address local housing demand	involvement with housing trust to provide suitable sheltered housing and varied dwelling provision			A		80 years+		
Loss of amenity value of the immediate area	medium	house price drop		contextual design			A		2-5 years?		volatile
Rapid increase in local amenity value	low	house price sudden rise		contextual design and varied provision			A		2-5 years?		volatile
un-ethically sourced materials	high (if un-controlled procurement route used)	social impact		specified for significant materials	controlled list of banned materials		A&B	Develop could take measures to control incoming tenant fit-outs			cannot readily control any work done after completion

Security compromise to lower parking deck at night	medium	theft and personal attack	need to address increased requirement for larger spaces in the future	supermarket to take responsibility for security	Gold standard design for car parks		A&B .		20-40 years		95%

Figure 6-2 Concept Proposal IDEAS

6.5.2 Proposal 2: Sustainability Risk Register I

Following the pilot study, the framework was developed incorporating the findings of the first proposal. Also the industry leader solution was placed first to make it the first mitigating response the risk that the client read, which might encourage the client to consider it more deeply. One of the major issues was that the client could not be at all clear of specific in the first live project was the level of profundity they wished to pursue, and the client's policy statement was included.

Live Project 2: Group Offices

An initial pilot study was carried out on a new headquarters building proposals. The project was to form a three storey office building from an existing 1960's building on the outskirts of a city. A senior technician led the trial with an internal environmental consultant. The initial response to the format was encouraging. The principle of completing the framework matrix was accepted and developed during the briefing process to provide a statement of criteria and targets in the Employers Requirements document for contractors to tender a Design and Build contract.

The following observations and recommendations were made by the senior technician;

1. Identification of sustainability risk headings. There exists a problem of an issue being forgotten or avoided, this could be prompted by a list of suggested areas, and alternatively the list could be pre-entered. It should remain flexible however, as a small scheme might have issues that would be beyond the scope and control of the project stakeholders, and some may have very many issues to consider
2. Inclusion of risk and likelihood headings. These were considered to be unnecessary to the majority of stakeholders however they aid balance of subjective arguments of the wider good against the specific interests of the client (see also item 4 below). This could be dealt with altogether in the related issues column.

3. Solutions or proposals. The order of the solutions columns should be reversed to show the "gold standard" solution first. These could be renamed to better reflect the environmental policy categories of industry leader, pro-active, active and passive.
4. Balancing the subjective argument against external issues. If there was a direct business benefit (or "who benefits") noted for accepting the A (pro-active/industry leader) solution, it would help with the business case. This might be divided into 3 categories, running-costs (supporting the clients own economic sustainability), employees (supporting the clients internal social responsibility policy), marketing led (this is primarily economic in specifically retail situations how ever the environmental and social benefits must be obvious to enable the marketing value of the solution). This is related to the philosophy of the solution, however it is defining which philosophy the solution depends on to be effective.

General observations;

1. This particular project was destined to be a Design and build contract. The senior technician believed that this form of contract considerably hindered the application of sustainability considerations. Not only is the obligation of the tendering contractors to save money through detailed design, but also to save time and money by reducing the design period and site programme. This situation limits innovative design and research by sub-contractors who are in-turn tendering at risk against not winning the particular work. As such any client with an interest in the application of their corporate social and environmental policies and the application of this type of project analysis would need to be steered towards other forms of building procurement such as Main Contracting where the contractor would appoint their own architectural and M&E consultants or traditional JCT forms where the client would directly appoint consultants.
2. The completion of the framework required some research on the part of the stakeholders, particularly in setting the annual yearly energy consumption target and which methods to suggest for analysis of materials, water use etc. This was considered to be part of the learning curve of the subject area.

3. Some considerable calculations were carried out to try to balance the cost of HVAC plant against fabric design. This work was at risk of being lost if the issues could not be linked in some way with design development, a situation that was again made difficult by the procurement route anticipated.

The project goes against conventional wisdom that narrow plan naturally ventilated new build office buildings are likely to be cheaper to construct and save energy and maintenance costs over the lifetime of the building (Weight, 2005). However, the structural shell was already re-used form an older office building, and studies of the users existing buildings had shown that opening windows conflicted with effective air conditioning operation and natural ventilation was ineffective on very hot days in another existing building. In order to keep energy use at an acceptable level, a kWh/m^2 rate was set at 175, including small power. Design calculations were based on the fullest levels of occupation and use possible and were calculated at $174kWh/m^2$. Carbon dioxide annual emissions rate of 80kg CO_2/m^2 was based on Energy Savings Trust energy calculation tool (2006). This is well within good practice guidelines and meets the Movement for Innovation recommendation for offices (Roaf, 2004). The project team hope that this is a generous assumption based on full use of all systems when the office is open to staff. Monitoring and feedback by a dedicated facilities manager is hoped to result in reducing this CO_2 output.

Perhaps the most critical issue highlighted in the above trial is the procurement method issue which was supported by the framework being included in the tender documentation. This prompted the need for an amendments column on the framework which allowed any revisions and substitutions to be logged and the completed framework inserted in the health and safety file with residual risks and possible future improvements noted. The issue of substitution became easier to manage when the client became more vociferous bout the reasons for the design decisions and the criteria being used. This became particularly important when an alternative carpet supplier was requested based on marketing literature describing the recycled content of the alternative product and specification by a major client of the construction company. An in depth comparison was then required to demonstrate the comparability of the two products, which resulted the original specification being retained an the grounds that the actual volume of material was less in the designers preferred carpet as they performed identically in all other respects (embodied energy, recycled content, backing material environmental impact, waste management, wear and appearance).

Sustainability Risk Register

Project :	Group Offices	4309
Inception date:	17-Feb-05	
Revisions:	A 08 Mar 05	
	B 27 Jul 06	

Client's Policy Statement: To have a building that demonstrates good environmental and sustainability practice without paying a premium for "cutting edge" technology, if the building were to be awarded a medal for performance the target should be to achieve "silver" standard.

Risk to Sustainability	**Likelihood**	**Risk**	**Issues related or affected**	**A Minimum solution**	**B Current "Best Value" solution**	**C Maximum solution**	**Selected remedy**	**Positive benefit of selected Solution**	**Futurity (how far ahead can we reasonable plan for?)**	**Measurement or criteria targets**	**Philosophy (is the selected solution technology, human action or ecology based?)**	**Risk fully mitigated?**
Co2 output	high (air-conditioning expectation)	global warming future increases in tax levy on energy future energy price increases	Future potential for much more efficient systems, solar gain and increased summer temperatures	no AC or limited	AC managed to reduce loads	CHP plant using carbon neutral fuel source, ie bio-diesel, wood chips from locally derived source.	B	AC provided to meet client and staff expectations. AC designed and controlled to avoid over specifying plant and provision of little used capacity. Automated controls to be applied to minimise energy usage	15years	200 kWh/sqm/year (for whole building energy uses all sources), subsequently revised to 175 at tender and proved by supplier by calculation at 174kWhr/sqm annum	technology and human in respect of control maintenance	Review in use and at end of 12 months and periodically therafter by Facilities manager

Co2 output	high, existing fabric needs upgrading	global warming future increases in tax levy on energy future energy price increases	Limitations of existing structure	build to building regs for fabric and air tightness with good practice and quality workmanship	exceed standards(may have negative impact on the use of materials against CO2 saved)		B	Reduced emissions and allows ac and heating plant to be minimised	envelope life 60 years	Linked into delivery of whole building target energy use. Materials selected on environmental grounds	technology validation by air pressure test and thermographic imaging	Tests carried out building is compliant with current air permeability regulations at completion
Increased water consumption	medium	resource depletion, cost increases		limit supply where possible, ie taps and cisterns etc	collected rainwater for WC's,	composting WC's	B	Cost benefit sewage is charges on the basis of water into the site through a meter	20-40 years	water use target? Also note that aggregate of new toilets in Dynex will be less than current aggregate of toilets within the group saving on water maintenance and cleaning	technology	Rainwater harvesting for wc and urinal flushing implemented. No easy method of measurement
Increased rainwater run-off	medium	local flooding and watercourse pollution	car parking area and travel to the location	storm storage	landscaping design permeable paving, porous surfaces		B	may produce capital costs savings against storage	60 years plus	Discharge rate from site	ecology	Permeable paving used to all new roads and car parks

un-sustainable sourced materials	high	loss of habitat (particularly in case of timber)	D&B contractor design	specified for significant materials	ban significant materials and impose fines for use	select all materials on environmental merits only set target Green Guide to Specification (3rd Edition) rating for each material	C	Ensures sound environmental choice of materials	20-40years	BRE calculation methods available	technology and human	Best value green materials selected as far as possible
Waste production to landfill (Build Phase)	high	landfilling and resource depletion	Construction waste / costs of disposal	Accept losses as the norm with loose agreement to minimise where possible	Segregate waste, recycle, minimise over ordering	Fully manage supply chain minimising waste at all stages, just in time delivery, minimise double handling of materials, source locally to minimise transport costs	B	Cost	Construction period	Overall waste target with penalty clauses	human action. Considerate Contractors scheme Registration	Management strategy, tender interview issue, dependant on successful contractors attitude. Facilities manager will need to monitor and report on in use waste

Waste production to landfill (occupation Phase)	high	land filling and resource depletion	large paper volumes and other stationary materials	Recycling and waste management	Office management to reduce waste production	Attempt zero waste to landfill	B/C	Cost	5-10 years	set annual volume targets?	human action / job function of building manager to be appointed	% to landfill will decrease with management strategy and as good habits become established. Methods being developed facilities manager to continue to monitor
Energy use in building	high	global warming future increases in tax levy on energy future energy price increases	use of building running costs comfort, green credentials	Standard design to Building Regulations	Innovative design, movement sensors to lights CO2 detectors in vent system, local task lighting, separate circuits on time clocks for non essential systems	Maximise fully energy savings, single desk lighting, highly complex control systems	B	Green credentials, running costs	5-10 years	Part of overall building energy footprint	Technology/human/ under remit of building manager for education/policing	Minimum running costs/minimum environmental footprint. Facilities manager to monitor and target improvements in use
Furniture	hign	Green credentials	Cost and appearance	Buy on appearance / function	Set minimum standards of environmental provenance	Purchase based on environmental grounds including source of material and transport costs	B	Cost/Green credentials	Fit out period	Environmental rating of furniture	human action within Simons Groups Control	Furniture select with environmental credentials being considered.

Maintenance losses	high	waste production and recourse depletion	Design and detail by D&B contractor	Ban significant problem materials /items	apply WLC comparative calculation strategy in selection of specific elements, materials and finishes		B		15years	WLCF method available?	technology	Not factored into design to a great extent
Transport	High	Increased fuel levy, road cohesion, car parking tax, public opinion	Staff travel to work	Accept current status quo and provide parking to suit	Investigate and promote alternative transport strategies	Reduce parking provision and enforce alternative transport proposals	B	Staff issues/green credentials	Ongoing	Car journeys as against other journeys to site	human action	Internal policies and procedures to be developed and supported, car sharing notice boards, investigate other transport routes. To be developed by Facilities Manager and Simons

Table 6-5 Sustainability Risk Register for Live Project 2

6.5.3 Proposal 3: Sustainability Strategy Document

This format remained very similar, but tried to shift the emphasis away risk analysis element as this was felt to be demanding that the design team speculate on the likelihood of very large-scale issues such as the effects of global warming, frequency of water shortages or availability of landfill space. It seemed better to assume that these were the risks without quantification. It would be better to and shift the focus to a more positive strategy title.

Live Project 3: Mixed Use Retail and Leisure Shell Development

The scheme comprised of an anchor department store, 27 A1 retail units of various sizes, 3 A3 units, multi-screen cinema and bowling alley, a covered market hall to replace an operating but run-down site and a 900 car multi-storey car park. The scheme also required a trading-hours road closure to link two pedestrian thoroughfares.

This project had proceeded to the design stage (RIBA stage C) at which it had become necessary to develop a sustainability report for an outline planning submission. The project also required Retail Impact assessment and Traffic Impact Assessment. As a town centre brown field site with a number of redundant buildings and an historic clock tower, an environmental assessment of existing species had been requested, Himalayan Balsam had been identified as a notifiable weed, and bats were though to be roosting on some part of the site. Archaeological surveys and reports were also anticipated. The local authority had already confirmed that an environmental impact assessment was unnecessary due to the very poor environment existing on the Brownfield site.

It is important to note that this particular trial commenced on 13th September 2005 as the draft Part L2006 documents were released and that the scheme was expected to be submitted under the new documents (i.e. after April 2006). It had been established that these documents would be significant in the detailed design process as this would be one of the first large shell retail schemes to be submitted by the design team under the new regulations. At that time, a CO_2/m^2 consumption best practice guideline for retail shell developments could not be obtained.

The framework was used in the SRR format to develop a basic strategy using the drawings at the level of development that had been established. This allowed discussion on a number of points, which effectively formed a sustainability brief for the development in the form of the framework document. This was then turned into a report format it manner expected for public consultation through planning authorities along with the movement and retail impact assessments developed by the planning consultants team.

It is significant that the primary document used to justify the development of the framework briefing was the companies own CSR policy. It also respected the likelihood of tenant policy and investors policy as the development would need to substantiate the sustainability statement at the point of sale at completion to a major financial institution.

The case study has demonstrated the wide held belief in development that sustainability cannot be achieved as commercial concerns are too important. In fact, the need to create a product that will suit the investors sustainability requirements are more significant. Of course the developer is still bound to ensure that they have a profitable outcome, but the introduction of sustainability criteria into the design and development process at the earliest possible stage may help to better the profit levels. As an example, service charges to tenants can be charged at market rates, but maintenance costs limited by good design and management.

The power that the planning authority can weald is crucial to the success of the scheme and avoidance of delay in the planning stages will be beneficial, therefore, the planning process can be a major incentive to the developer in creating sustainable solutions. The use of considerable resources to create a town centre improvement such as this scheme cannot be avoided, however, it is possible to ensure through careful documentation and management that the environmental impact of the scheme is controlled and the social benefits are maximised whilst still ensuring an economically sustainable outcome.

Sustainability Strategy Document

Project:	Mixed use retail Site			**Client's Policy Statement:**							
Sheet number:	1										
Inception date:	15-Sep-05										
Revisions:	20-Oct-05										
Risk to Sustainability	**Industry Leader Solution 4**	**Proactive Solution 3**	**Active Solution 2**	**Passive Solution 1**	**Selected remedy**	**Internal benefits**	**External benefits**	**Futurity / re-analysis trigger point**	**Measurement or criteria targets**	**Philosophy (is the selected solution technology, human action or ecology based?)**	**Point at which risk is fully mitigated**
Environmental considerations											
Co2 output	Implement on site electricity generation facilities (subject to planning approval issues)	Set energy usage per m2 target below Part L requirements	Provide independent metering by tenant to allow selective electricity sourcing	Achieve Part L compliance (2006) for Co2 output per area					Co2/m2/year		
waste management		Design for maximised recycling of building materials	Provide provision for shared waste separation and compaction facilities	Comply with Local Authority requirements (providing compactor locations for shared use)					limits to landfill waste output		
materials	requirements for GG specification etc in tenant handbook	Green Guide or National Green Specification with local sourcing obligations	Material life cycle analysis using BRE Green Guide and National Green Specification	standard shell specification subject to planning approvals							

water use		Rainwater harvested for WC flushing	low flush WC's	Meet LA requirements					Usage will be low except for leisure tenants and anchor store (Debenhams) both of which may be fitted out by tenant?		
rainwater run-off			provide rainwater containment with possibility for reuse in WC's. Design landscaping to maximise permeability	provide adequate new drainage							
Transport			enhanced facilities for cycle parking and pedestrians	Traffic Impact assessment and planning requirements to be met							
Local environmental impact			Provide alternative habitats within site subject to report	Assessment of site habitat and planning requirements to be met							
Light Polution			Site lighting to minimise upwards illumination	Signage for tenants to be subject to LA requirements							
Localised biodiversity			Roof level landscaping (sedum roof)	Landscaping scheme							
Construction phase: Waste Management		Compactor hire for cardboard paper and plastics	Skip separation								

Change phase: Waste management			tenants required to strip out and dispose of all materials responsibly								
Social considerations											
Historical impact			Built heritage reflected in scheme façade designs	Retail clock tower, archaeology report and observations							
Cultural impact			Provision for external events site	new leisure proposals							
Design quality				Design Council for Wales requirements to be met							
Retail amenity			Provision for external Farmers Market site	Proposed retail units to suit tenant demand							
Employment				Proposed numbers submitted to local authority							
Noise			Provision of fencing or planted attenuation screening	report and LA requirements to be met							
Visual		Minimise signage allowances	roof plant screening	LA requirements to be met							
Traffic				report and LA requirements to be met							

Community links		encourage business in the community involvement groups within tenants organisations	Consider local schools involvement in arts project	information website							
Safety/securiy			Designing out high risk areas	Adequate lighting and CCTV coverage, managed servicing routes							
Construction phase : Noise			Considerate contractors scheme	H&S requirement s met							
Construction phase: Traffic			Considerate contractors scheme	H&S requirement s met							
Change phase: Retail/visual Amenity			Hoarding and information requirements to tenant	H&S requirement s met							
Economic considerations											
Maintenance costs			Whole Life Cost evaluation of shell fabric	standard shell specificatio n							
Servicing costs			tenant metering								
Retail Need and turnover				Retail Impact assessment and planning requirement s met					ten years (report to 2011)		
Change phase:											

Figure 6-3 Proposal 3: Sustainability Strategy Document

Sustainability Risk Register

Project:		Water Sports Centre	
Sheet number:	1		
Inception date:	20/12/2005 detailed design stage		
Revisions:	A 05/01/2006 design team review		
	B 15/02/06 Clients selections noted		

Client's Policy Statement: **Improve sustainability credentials**

Risk to Sustainability	**Industry Leader Solution 4**	**Proactive Solution 3**	**Active Solution 2**	**Passive Solution 1**	**Selected solution**	**Internal benefits**	**External benefits**	**Futurity / re-analysis trigger point**	**Measurement or criteria targets**	**Philosophy (is the selected solution technology, human action or ecology based?)**	**Point at which impact/risk is fully mitigated**
Environmental considerations											
1.0 Co2 output	on-site generation	specialist plant	plant design and management	fabric	3	User groups are responsible for utilities costs	demonstration project status	new technology	energy use/m2 $<10kgCO_2/m^2/$ year	technology	zero carbon output
1.1 heating and cooling of space		Heat pump or heat exchange system to be investigated. Minimise areas under mechanical control	Plant design and controls to minimise energy use	Maximise thermal performance. Maximise natural ventilation with high level opening lights. (cooling demand very likely to syndicate room) Shading to west and south facing glazing with glass specifications to appropriate orientation	3	fresh air improves internal environment and educes risk of sick building syndrome	visual and planning issue with externally mounted air handling units			technology with human control	

1.2 lighting and small power services	on site energy generation by wind turbine with storage battery and ROC metering facility		minimise lighting requirements in daylight hours	low energy fittings and control systems, obtain mains electricity from green provider	4	possibility to sell back to power grid	wind turbine feature to public. Site has been sited to maximise launch breeze for dinghies, turbine will also act as wind speed signal. (wind speed, air and sea temperature display could be integrated?)				earning ROC generation income
1.3 Hot water		solar water heating with mains back-up and storage capacity to allow for peak demand periods		low wastage fittings and thermostatic mixing	1&3	brackets as part of glazing design to mount vacuum tube collectors can provide solar shading		system installation - replacement/payback period		technology	no mains input required
1.4 Cooking				Gas cylinder or mains?	1 Mains			Availability of biogas system cooking?			
2.0lin-use waste management			planned supplier collections for high waste output risk in bar and café (i.e. bottles)	storage areas for waste separation	2		Provision of communal recycling services nearby could benefit marina users and general beach users rubbish collection		by volume in use	human action	zero landfill waste collection

3.0 Materials		recyclable and recycled or reclaimed materials to be specified	low embodied energy and local sourcing	sustainability sourced materials, particularly all timber	2&3	contract form to prevent substitution of specified products.			BRE/ good specification guide ratings	mixed	
3.1 Structure		water proof concrete specification to maximise lifespan of concrete structures	minimise concrete volume and use steel structures above high water risk areas.	solvent based intumescing paints will be necessary to steel due to high environmental exposure	2&3	maximise building security and storage capacity at lower floor		building life?		technology	
3.2 Envelope		Recyclables of Kingspan wall and roof cladding at replacement. Plan for reuse and recycling of other replaced finishes	Obtain cedar cladding within Europe if possible. Stone cladding to be locally sourced.	Insulation products to be specified as acceptable in terms of CFC emissions, combustibility and production impact.	1,2, 3	Good external appearance to be maintained		exterior to be maintained by Ports of Dover. Specification of finishes to suit established knowledge of the coastal environment			
3.3 Interiors		where suitable, recycled or reclaimed materials to be specified (bar counter top, timber cladding, safety flooring etc)	Materials to be selected with supplier guarantees for environmental credentials	minimised painted surfaces. Omit ceiling where possible	1,2, 3	Maintenance of finishes will be required in upper floor areas.	Use of visually apparent recycled materials to make appropriate statement	approx 5 year major maintenance cycle?	Maintenance schedule will be required for all internal finishes.		

4.0 Water use			collect rainwater for flushing	minimise usage in sanitary fittings but maximise storage tanking and WC refill for peak load periods	2	ease peak demand and group changeover times			minimum meter top up volume	technolgy	
5.0 Waste soil water				minimise usage in sanitary fittings	1	pump will be required to reach street level foul drainage				technology	
6.0 Rainwater run-off			collect roof rainwater for WC flushing	beach soak away	2	Large expanse of roof cannot be used for solar generation due to pitch					dependent on adequate rainfall patterns in peak use season
7.0 Transport				encourage public transport use/ cycles and secure storage area	1	staff health benefits	limited parking availability		in -use stats	human	zero car use
8.0 Local environmental impact				meet planning requirements	1	lateral sand and gravel movement has been noted					

9.0 Light Pollution			switching and controls for reduced use in darkness hours. LED type fittings where possible for low maintenance and energy.	minimise illuminated signage, downward facing fittings for security zones particularly under balcony	2	beacon statement lighting and signage is required	beach lighting is required for safety and security around the building			technology	
10.0 Localised biodiversity						Limited impact anticipated. Consideration required for vermin control?					
11.0 Construction phase waste management	Demonstrati on project reporting for best practice	Subcontractor s to be managed to reduce, reuse and recycle	site skip segregation for waste management and costs savings	minimise costs of site utilities	2&3		High profile project			Contractor to demonstrat e understandi ng of issues and environment al manageme nt plan (or Considerate Constructor s Scheme membership) in tender submission	
11.1 Demolition				off-site buildings to be demolished, waste materials to be reclaimed where possible	1		Strong public feeling regarding the appearance and facilities on the beach				

11.2 Excavations				Augured piling with test pile to minimise over design on substructure	1						
11.3 Works above ground			base to extend around building to provide scaffold base for construction works and maintenance thereafter.	complete envelope to provide early weather tight interior and limit heating and drying costs internally	2						
11.4 Interior fit-out			obtain use of plastics and cardboard compactor for removal of waste packaging in reduced no. skips	avoid wet finishes to minimise drying costs	TBA						
11.5 Re-fit and maintenance				avoid short replacement cycles on interior fittings and surfaces self-finished waterproof concrete in lower floor areas	1						
Social considerations											
Historical impact				These issues already dealt with in planning proposals			building is required to be a landmark in context				

Cultural impact							providing a cultural "landmark" for water sports and beach users				
Design quality		entrance canopy re-design to be undertaken	sustainability intent to be apparent to visitors and users								
Employment											
Noise							Potential noise of wind turbine to evaluated (measure current background noise)				
Visual						beacon status of signage and lighting					
Traffic							impact on nearby parking				
Community links		contractor to promote active community participation and links	user group input to be managed								
Safety/securiy			active CCTV systems	avoid high risk/dark spots	1		Coast guard will require good visibility of the beach areas				
Construction phase : Noise	To be managed by contractor, client requirements to be included in tender documentation						driven piling to be avoided				

Construction phase: Traffic							temporary ramping and hoisting arrangements for delivery of materials will affect pavement on seafront, consideration of parking for contractors				
Change phase:				scaffolding arrangements will allow for hoarding			Programming of future construction works to be evaluated				
Economic considerations											
Design developement costs			option for additional environmental evaluation by third party such as BREEAM	Expected to fall under revised Building regulations with current programme	1						
Construction costs		Increased material costs to be avoided	Increased plant offset by reduced services and maintenance costs	Value engineering to be carried out on proposed options. Increased material costs to be avoided	2						
Maintenance costs			Cost of increased storm damage risks over time	Planned maintenance by experienced client team	1						

Change costs			Impact of change in high water/beach structure to be considered. Extended summer period will increase revenue from bar/café	long life cycle anticipated	1		Affect of nearby proposals for new hotel to be considered				
Servicing costs			record monthly meter energy obtained from wind turbine and rainwater collection volumes	Metered monthly mains services recorded	2	reduction of utility costs by good management is in the interests of the users. Facilitator to be appointed within staff to manage programme for on-going improvement					

Figure 6-4 Proposal 4: Sustainability Risk Register II

6.5.4 Proposal 4: Sustainability Risk Register II

Following the draft publication of the AD Part L (2006) UK Building regulations, the requirement for a building log book was identified. This document appeared at the time to be an extension of the Health and Safety file which would have more detailed and user friendly information for building owners, users and facilities managers. It was also identified that the carbon dioxide output of retail project was to become important. This was expected to be problematic in small projects where M&E engineers were unlikely to be appointed or raise the need to appoint M&E consultants for general services on a time charge basis.

In order to match this schedule to what were the perceived requirements of these legislative changes, and particularly as projects that would be subjected to the new legislation were under design development a more positive approach to the framework was reached. This was also an attempt to address the way in which documents are kept as a sideline to the design scheme rather than central to it.

Live Project 4: Water Sports Centre

This water sports activity centre had been designed two years earlier and had been on hold whilst the client business and charity partners secured funding. A re-launch was proposed in December 2005 to review the scheme that had reached planning approval but had proceeded no further, and with the additional caveat of funding for a sustainable design. This prompted a design team review using the sustainability strategy format document managed by the design team.

As considerable work has been invested in the layout and arrangement of the building with he future user groups and facilities managers, it was assumed that the application of "sustainability" would not require a radical design change. The team set about reducing energy use through plant, building envelope design and optimising wind and solar energy available on the beachfront site. It was also deemed important to constrain the specification to include environmentally benign and locally sourced materials and reduce volumes of less benign materials wherever possible. The aggressive marine environment was also a significant factor in maintenance, whole life costing and related product specification. It was assumed at the early stages of the exercise that the clients policy was as the recorded brief for the design team provide a proposal for a renewable energy review and report on the project as the Trust would like to see this building as an acknowledged example of good practice and further funding would be available to the trust for renewable energy and sustainable construction issues.

The format was introduced to the M&E engineer, structural engineer and cost consultant as an approach to document the design strategy throughout the design and construction stages and to be kept in the operations and maintenance documentation of the project. This was readily accepted as a useful way to maintain a project wide understanding of the changing project parameters and targets. It was identified that as a traditional JCT contract would be used, it would be very easy to ensure that the project had no contractor substitution of materials. It was felt that despite the limits of the M&E design teams experience, the specific energy reduction and generation elements such as solar water pre-heating, wind turbine and heat recovery plant could be managed in a way that allowed subcontractor design expertise to be optimised using the strategy document to define targets and monitor these post –completion. The issue most difficult to resolve at that time, was how an energy use target might be reached in view of the project being submitted for building control approval after the proposed revisions of April 2006.

The project commenced use of the strategy format in advance of the initial re-launch presentation to the client. The success of this format could be accountable to four significant factors; The high profile nature of the project and the way in which the funding was being secured allowing the emphasis on sustainability to be developed, the user groups direct responsibility to pay utility bills allowing an active interest in reduction of these, the form of contract being used allowing control to be exerted by the design team and the experienced and planned maintenance mechanism that Ports of Dover would be applying to the exterior of the building informing the design team of the best approaches to take on materials and finishes selection. Although not a retail project, the building had a number of aspects that are parallel to commercial schemes. The beacon status accorded to the schemes facades and key features such as signage, the landmark "spike" which was the all too obvious location for a wind turbine being comparable to the shop front, external lighting and signage elements and the café/bar interior which had very similar finishes and details to a retail environment. The factor that allowed considerably more potential for energy savings was the envelope fabric being under the control of the client and design team.

There had been a design model of the scheme produced for planning processed which off-set the design cost of sun-path testing of the facades. Modelling of the heat recovery and solar gains by the M&E engineer was also facilitated by this. Many retail interiors projects would not have had this 3D modelling carried out which would increase the cost, however, development projects have a high likelihood of having this carried out for Planning Approval submissions which offers the benefits of a 3D model effectively without additional cost.

During the course of the project design, it became apparent that changes to the framework needed to be documented more clearly leading to a column being added to record amendments with a date and author.

6.5.5 Proposal V: Sustainability Risk Management Matrix

This was the final iterative development of the design methodology framework, only small changes were made to the structure and terminology in this iteration. The term "*anthropocentric*"; human centred action was introduced to replace *deterministic* due to difficulties in explaining the meaning of this term without recourse to the theory of the framework for sustainability in chapter 2. The ranked action columns were made as wide as possible to accommodate more detailed descriptions. Risk analysis remains an assumed ranked list (comparative RA) without quantitative analysis. This should allow a sense of prioritising, but could have enough flexibility to allow the ranking to be modified for different projects rather than imposed.

6.6 Industry Validation

This section aims to document the validation exercises carried out during the course of the framework development and the conclusions they provided.

6.6.1 Industry Validation at Conceptual Level

A presentation was made to the Women in Property conference in Birmingham 24th-26th September 2004 which was entitled "Development for the future- responsible, sustainable but is it feasible?". Around 70 delegates from a variety of property backgrounds including some retailing interests received 4 speakers on the morning of 25th of September. The other speakers were John Calcutt Chief executive of Crest Nicholson PLC and spoke about sustainable house building, Jacquie Reilly, National Project Director of Business Improvement Districts Scheme who spoke about the BIDS project and Gareth Llewelyn from National Gas Transco who spoke about their Corporate Responsibility programme. In order to gauge response to the work a feedback form was inserted into the conference pack, however to date, I have not received any completed forms. The presentation focused on the typicalities of retail environments, the problems faced by retailers and a few examples of way problems have been tacked by retail projects carried out at Simons Design. The presentation then focused on the criteria developed in chapter 2 and how they might be applied.

Questions from the floor and at the concluding discussion at the end of the day suggested that;

- Some retailers are trying to improve the performance of their facilities (in particular points raised by a representative of HKSB spoke about their rural eco-branches which concentrate on local sourced materials, low energy lighting and accessibility.

- As customers, many people do not feel that they have sufficient buying power to affect retail practices.

- As consumers, many people had not recognised any environmentally angled marketing except some supermarkets and energy companies.

- It was not felt that (the majority of) retailers would change their practices without legislative intervention.

I am not sure that the criteria were fully understood, and this may be partly due to lack of time for deep explanation and also lack of good examples. This re-enforced the problems of how to apply the criteria in the real world in an equitable manner.
The result of this exercise was that the conceptual framework was meaningless to stakeholders without a real example or scenario to express it with.

6.6.2 Industry Validation at Concept Proposal Level

A client event held by a construction company was used at an audience for an investigation in chapter 5. Forty key figures from the client list, 50 percent of which from retail organisations, others mostly from investors and developers involved in retail and mixed use schemes were given a short presentation followed by a request for completion of brief questionnaires to compare data against that of the construction professional's survey. The presentation included conceptual process and linked findings from the construction professionals' survey. Main aim of the presentation was to introduce the research to the audience and invite interest in participation in trailing the structure in real projects. Results from the consultants opinion survey were included in the presentation.

Response to the proposed structure was minimal, however, the trails using case study projects had commenced at that point, however this occurred in a period (March, 2005) just before interest in sustainability in retail clients began to grow. It is my belief that the same presentation given in 2006 would have had a greater response.

6.7 Content Review at Working Proposal Level

This evaluative process was carried out as part of the experiential learning iterative strategy to obtain feedback from a wider audience.

6.7.1 Research Tactics

A policy statement was developed to explain the procedure of sustainability risk management; this was submitted to a number of client representatives for comments. The commentators were selected as representing a broad range of environmental awareness and included commercial and social enterprise groups.

6.7.2 Client representative for a large multi-function organisation

This client has a varied portfolio of buildings including transport terminals, offices and small commercial properties.

> *"From a client's point of view my only comment would be that it is a bit techy and could do with more of an explanation on some of the headings and considerations. i.e what does industry leader solution 4 mean?*
>
> *Having seen the output for the Sea Sports Centre I think I probably understand better what you are trying to get from it but I think some clients would find it a bit daunting. Perhaps an example might help if you are intending to send this to clients.*
>
> *Other than that just a minor comment that your spreadsheet is titled 'Sustainability Strategy Document' whereas the text is titled 'Sustainability Risk Management Policy'. The two mean different things to me.*
>
> *As far as acronyms are concerned how about 'SIA' for Sustainability Impact Assessment?"*

Following this feed back it is obvious that the format of the matrix may be too academic for the client audience. There are two ways to address this problem; either change the headings to more generic terms, or use the comment function in *excel* (which appears as a small red triangle in each cell. Thirdly this could be presented in both formats depending on the use level intended, but this could place the team in the position of deciding which is more appropriate for the client or when to move from the lighter version to the heavy one. The preference is for the comments function, but this is limited to being visible on screen whereas in meetings the matrix is more likely to be in discussed from a printed version. The ideal solution is to do both; using simplified titles and the comments function in *excel* to expand the definitions.

The comments regarding a worked example is very prudent and to be included in the dissemination presentation.

The third point regarding the name of the matrix has not been raised with all of the commentators. The natural name is sustainability risk management register or matrix (SRMR or SRMM) neither of which provides a useful or memorable name. I do not agree that the matrix is the same as a sustainability impact assessment as this might conflict with the written statement developed at planning application stage.

6.7.3 Retail Distribution Facility Contract Manager

> *"From my experience with [client], my comments are as follows:*
>
> 1. *The matrix will be suitable for those projects with a very long lead in and in which the 'responsible person' is involved from early doors. It reads as if it were for 'negotiated' projects (and I can see where this works well with you relationship with [development clients]) however would become very difficult to fill in for tendered projects where there are many givens already.*
>
> 2. *Would a second abbreviated form be of use for these 'tender' situations (i.e. where 'grants' etc would have been considered, planning received far in advance) so that it were simpler to fill in?*
>
> 3. *What 'form' are the answers? Yes/No, %ages, out of 10? Is it that the form could be made objective and not subjective so that there is parity when it is compiled? Perhaps a staged approach going into greater detail as necessary as it progresses? Have you completed the matrix on a live project as it would be good to see a completed form for my understanding.*
>
> *It is clear that you have put a lot of work into this and, my comment would be as a 'contractor' that we would expect a specialised consultant to complete this document and have the necessary skills to be able to follow though compilation of the necessary data you make note of in 6. "*

This feedback does not prompt the modification of the format, but highlights the need for a structured approach to implementation and training of the responsible team member for maintaining the SRM Matrix.

The respondent notes that some issues are agreed when they take on the project at tender stage. This would be true of many of the social and environmental issues that relate to the siting of the building, transport plans, general form and scale, by Planning

Approval. In this case, the SR manger would note that these were non negotiable items and that any risk was accepted. Having a worked example will be helpful to allow new users to feel confident about how to complete the matrix, including a range terms or figures, particularly for targets.

6.7.4 Head of Sustainable Development for a Regional Development Agency

> *"I'd ....like to challenge [the] approach' -*
> *it seems to be a reactive one i.e. won't do this, or go beyond Building Regulations standards · unless client stipulates. This is very different to some of the leaders in this field in the construction sector, such as Carillion, which do it as a matter of course. Adopting a new approach could win an awful lot more clients; costs are no higher when considering 'whole life';*
>
> - *Should adopt an approach that embraces not just 'risk management' but also 'opportunities'*
> - *Would be well worth getting hold of the 'sustainable construction' checklist from BRE/WWF gives the full brief of issues/aspects to look at to ensure 'sustainable construction'. Some are covered, but not all in the [SRM Matrix].*
> - *Would be worth getting hold of the sustainable construction corporate material from construction sector leaders such as 'Carillion', who seem to have a very robust approach.*
> - *Rather than just taking a 'responsive' approach, i.e. not doing this unless 'triggered' by client needs requirements/spec, what can Simons do to make this the norm, i.e. sustainable build may be slightly more expensive, but whole life costs are significantly lower for sustainable build.*

The following points respond to these comments;

The respondent has made an assumption that this is a model for sustainable construction which is not the case; it is for sustainability in the end product building, although sustainable construction is a vital part of that process. Carillion's sun diagram (Edwards, 2005) is about how they do business not about establishing a project specific design management model for each project which is the client need that this research has established.

The process was developed from the base principles of the problems associated environmental impact and waste in retail architecture and their very short life cycles, which cannot be effectively evaluated by whole life costing.

The approach of the design methodology framework is to encourage clients into a new mindset. This requires a CEO level decision to commit to considering sustainability. By taking the risk management approach, this seemingly very negative stance forces our clients to consider their responsibilities, where otherwise they would completely ignore them and merely meet legislative requirements. It is neither possible nor effective to try to force the retail client to spend money on an initiative that they do not see a need for, they will not pay for anything that is not in their client requirements, and will not actively change their approach unless forced to by planning authorities, their customers or as part of CSR reporting. It is agreed that good design should always support sustainability and sustainable construction should be an industry standard, but this is only part of the picture.

The responsive approach is the approach most suitable for use with commercial clients, and this is based on literature review and field data. The only opportunities open to contractors is in upgraded substitution of materials (where more sustainable products replace those of greater or equal monetary value) and in good site management practices.

The SRM Matrix is aimed at managing the risks of sustainability to the clients own CR policy in the longer term, not managing sustainable construction in the case of the DTI reports stated and the BRE developments publication (Brownhill and Rao, 2002) which is a similar document to BREEAM assessment for planning purposes supporting subjective analysis of design proposals. The checklist would be a useful aid to the design team to identify risks and mitigation strategies, but not substantially better than BREEAM Criteria, and not specific to the retail situation.

These comments have not initiated any alteration to the SRM Matrix, however it is useful to gauge the response of an external organisation.

6.8 Conclusion

The aim of this chapter was to demonstrate the development of the framework from the initial conceptual proposal to a design methodology framework application using an Experiential and Iterative strategy. This process has demonstrated that the conceptual proposal has been utilised on live projects and sustainability has been more significant in these projects. The extent to which this has been successful is as much to do with the client's policy and requirements as the use of the resulting SRM Matrix. To prove that it is the SRM Matrix that is effecting the change is hindered by the limits to replication found in live projects and the number of other factors that are involved in developing a design project. It could be true to say that where the client has a policy statement that required demonstration of sustainability, the SRM Matrix will support delivery. Conversely, the client that is unwilling to make such commitment will not find the SRM Matrix particularly beneficial.

There is a very real need to put in place observation and facilities management programmes in the case study projects that have been designed and continue to be developed using the framework. Limitations of this research have been stated as the availability of case studies within the time frame. However the working practices to use the SRM Matrix have been established and will allow this method to be adopted in other projects. The measure of success is difficult to ascertain without completed projects that have been monitored in use. This further study would allow significant correlative research to be carried out; however the unknowns and variables in how the human users of any building make use of it can make the comparison to design targets very difficult. Part L 2006 legislation is set to change the way retailers account for energy use, and this may provide a real drive towards the need for the framework approach to sustainability management.

The aim of this tool was not to provide a means to compare one project against another as they are often in unique circumstances making rigorous comparison difficult. As the framework is a response to risk, it can only be used in isolation to measure levels of responsibility. It is subjective by nature, requiring the input of a number of people and the main risks identified are likely to oscillate towards issues that have been covered in the media at the time that the methodology is being carried out (in 2006 this is most likely to be energy use, waste and water use and disposal). This does allow other risks to be treated as less important, but the responsibility of the design team is to manage the framework methodology in a responsible way.

The major benefit of this framework is that the SRM Matrix allows the risks to be considered as a step by step approach, but by keeping them together in one document, and by linking issues together, a holistic approach to a scheme as a whole can be generated. This supports treating the brief as an integrated system of activities where a by-product of one function can be beneficial to another function.

The next chapter will implement the SRM Matrix in retail architecture to demonstrate that the principles developed in this chapter support sustainability in retail architecture.

7 Implementation in Retail Architecture

The last chapter described the development of the proposed design methodology framework; the Sustainability Risk Management Matrix (SRM matrix). This chapter aims to demonstrate the use of the proposed framework in live projects and response to the SRM matrix in industry and academic fields. This will be carried out through four objectives;

1. To describe the implementation of the SRM matrix from the perspective of architectural practice.
2. To evaluate the potential for reducing sustainability risks on retail projects through the implementation of the SRM Matrix.
3. To evaluate the SRM Matrix as a working design methodology framework proposal.
4. To outline potential further development of the SRM Matrix.

The first objective will be met through a description of the content and process of the working proposal. The second objective will use *summative evaluation research* strategies (O'Leary, 2004) to investigate the effectiveness of the working proposal using live project data and simulated to demonstrate that sustainable retail facilities are a potential outcome of the implementation of the SRM Matrix. The third objective will use evaluative survey tactics to assess the effectiveness of the SRM Matrix as a part of the design process to bring about more sustainable retail facilities. The fourth objective will in conjunction with opinions gathered through an evaluative survey.

7.1 Sustainability Risk Management Matrix Methodology

The sustainability risk management (SRM) matrix has been developed through an action research iterative process described in chapter 6. This section defines the process of using the working proposal design methodology framework with the following objectives.

1. To describe the process of using the SRM Matrix
2. To make recommendations for successful implementation

3. To investigate opportunities for improving sustainability by using the SRM Matrix in live retail projects.

The process of the design methodology framework is demonstrated in Figure 7-1.

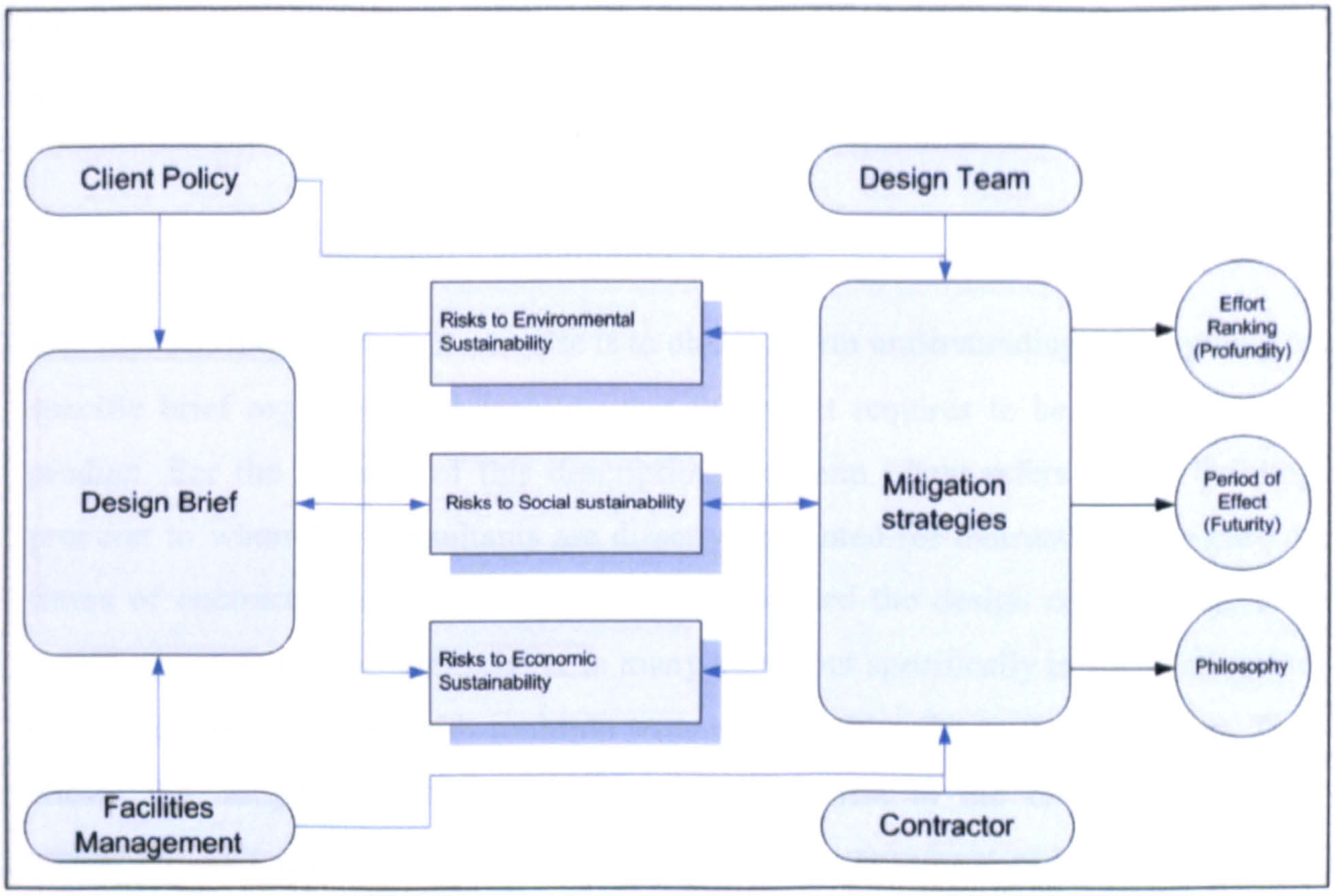


Figure 7-1 SRM Matrix process diagram

7.1.1 Format

The matrix is completed as an electronic matrix for ease of transfer amongst the project team but can be captured at specific points by means of a revision note and date. A responsible person is appointed to manage the matrix through the project. Involvement of the full design team is very important to the success of this method and any facilities management input that can be obtained from a variety of sources such as insurers, planning consultants, anchor tenants or other stakeholder groups is also very helpful. It is important that the building procurer (client) makes the final determination in resolving conflicting issues guided by the research and knowledge of their consultants. The framework is updated as new decisions are made in the design development stages, reviewed in meetings and appended to minutes. Any changes should be documented and the party affecting the change noted. The SRM Matrix aids the development of a written sustainability statement for planning applications by describing each risk response. The document becomes part of the *Client Requirements* or contractual documentation, thus ensuring that the contractor is committed to the responses it makes. It also informs the development of health and safety documentation and is central to the operations manual or building log book. Completing the SRM matrix is carried out in the following sequence. The headings are shown as they appear with hidden captions shown where they occur.

7.1.2 Obtaining the client's sustainability policy

The first and most important exercise is to obtain a firm understanding of the policy or specific brief regarding sustainability that the client requires to be met in the end product. For the purpose of this description, the term *client* refers to the building procurer to whom the consultants are directly appointed (or indirectly in the case of forms of contract where the contractor has appointed the design consultants). This would represent the end user retailer in many cases, but specifically in speculative and retail shell development with multiple tenancies would refer to the developer. This allows the design team to tailor the design response to the client's needs and aspirations in terms of responsibility towards the environment and stakeholders as well as the sustainability of the client's business. This stage is vital if the design team are to make realistic recommendations for their client.

Client's Policy Statement:

Figure 7-2 Client's policy statement

If the policy is in a simple format it can be inserted into the SRM Matrix as a paragraph or list. More complex requirements that are broken down into specific groups are inserted into the body of the form where they are pertinent.

7.1.3 Identify risks to sustainability

As established in chapter six, potential for negative impact posed by any intervention on the environment, society or economy can be viewed as a risk (to sustainability) in that there is a notional probability or likelihood that they will occur and a severity of outcome. These risks are noted as a possibility based on the knowledge and understanding of the project by the design team but the likelihood and severity are not included in the matrix. The design team identifies relevant risks to sustainability posed by the proposal in the first column of the matrix. These are outlined on the basic framework matrix in three main groups for environmental, social and economic risks, these are then broken down into headings, which can be added to and subdivided where there are a number of issues to be treated differently under the same heading. These are project specific and special prominence is given to the location, geography, culture and history of the site and the expected brief of the proposed development and the needs of anticipated tenants' sustainability policies in the case of speculative development.

The risks can be modified to align with specific requirements outlined by the client, to suit planning authority guidelines, RIBA endorsed checklists such as Gething and Bordass (2006). Each heading can be repeated for different tenants, functions within the building or phased parts of the work as suits the individual project and at the discretion of the consultants charged with carrying out the SRM process.

Environmental Risks	**Social Risks**	**Economic Risks**
Co2 Output • lighting • heating Cooling • small Power • other Processes Waste Management • general • tenant Materials • external envelope • interior fit-out Water use • sanitary • other processes Rainwater run-off • roof level • street level	Historical Impact Cultural Impact Design Quality Retail amenity Visual Amenity Traffic Noise Employment Community links Safety Construction phase • Visual Amenity • Traffic • Noise • Employment • Community links • Safety	Capital cost Revenue Maintenance Servicing Tenant turnover Change phase Disposal cost

Transport • staff • customer • general impact Local environmental impact Light pollution Biodiversity Construction Phase • energy management • waste management • transport Change phase • energy management • waste management • transport	Change phase • Visual Amenity • Traffic • Noise • Employment • Community links • Safety	

Figure 7-3 Identifying risks to sustainability

7.1.4 Identify responses to the risk.

Each risk can be tackled in a variety of ways and each is unique to the building form, location, function and any number of other issues. The responses are ranked under the headings the headings; industry leadership, proactive, passive, and active which allow the team to suggest options with a decreasing level of *profundity*. This responds to the criteria for sustainability set out in chapter 2.

Proposed action			
Industry Leading	**Proactive**	**Active**	**Passive**
Highest standards achievable with current available technology and best practice	Reducing impact with more radical and complex solutions	Reducing impact by exceeding legislative requirements	Achieves legislative requirements

Figure 7-4 Identifying ranked mitigating actions

It might be necessary to employ the advice of a specific consultant to fully explore the opportunities for certain sustainability risks, such as a retail analyst, hydrologist, planning consultant, archaeologist, conservation architect, botanist or landscape designer, micro-generation consultant. This would not occur until the client has made a commitment to proceed beyond the passive response, however, in complex schemes, the specialist may be appointed to successfully achieve even the passive response. Text is inserted into the matrix as appropriate and can be as detailed as is required. It is assumed that all of the mitigating actions will meet legislative requirements as an absolute minimum.

7.1.5 Identify selected response

The team reviews the options with the client and the client confirms which responses will be adopted, in many cases this may be the passive response, particularly following changes in legislation. The client may need further review to make a decision, and this would again trigger the appointment of a specialist consultant to provide a more detailed report. This is simply noted in the matrix as passive, active, proactive or industry leading. A fall back response may be identified if necessary, subject to funding or imposed planning restrictions. The client is able to change their decisions if necessary, and that might be to increase the profundity of the response as well as reduce it.

7.1.6 Identify related issues

Other issues may affect the decision and other parts of the design. These may be planning and local community issues, availability of applicable grants and tax incentives both within the client organization and in the wider community or management and organization issues that need to be reviewed. Positive benefits such as saving money on utility bills would be noted here. Difficulties that might be encountered such as approval to be sought from another organization such as an investor or regulatory body would be noted as negative issues. Again text is inserted into the matrix as appropriate and can be as detailed as is required. These issues may remain as open questions throughout the design of the project and be concluded on completion.

Related Issues	
Positive	**Negative**
Benefits to client or other stakeholders	Problems that may arise

Figure 7-5 Identifying related issues

There may be a relationship between the selection of the ranked responses and the positive and negative issues which may impact the business or the success of a project. In this case, the design team might make some assumptions about which response will be selected and provide positive and negative comments to explain this, which may prompt the client to take a more profound response than they might have previously intended.

7.1.7 Define design checks (Measurement criteria, period of effect, philosophy)

Design checks correspond with the criteria for sustainability of allow the design team and client to confirm the requirements that must be met by the design or contractors and sub-contractors.

Design Checks		
Measurement	**Period of effect**	**Philosophy**
Target design criteria or annual % improvement in use	Building lifetime, maintenance lifetime, and annual review	Technocentric - dependent on technology. Anthropocentric - dependent on human action Ecocentric - dependent on ecology biology or local climate. Or a combination of the above

Measurements or criteria that are relevant to each response should be established. This allows flexibility to meet the retailers CSR policy or requirements set out by local authority, or other assessment targets such as those set out in BREEAM assessment. These would typically include energy use kwh/m^2, percentage of energy to be obtained through micro-generation, material selection criteria, reduction targets in water use etc or a required payback period. The design team may use web based software or paper methods as deemed appropriate or preferred by individual consultants. Some risk responses may not have a definable measurement and this should also be noted. This measurement is transferred to employer's requirement documentation and contractor or supplier design specifications. It is thus particularly important when projects are to be tendered competitively or liable to value engineering at a later stage.

Period of Effect defines the *futurity* of the response, when it will need to be reviewed or if it will be effective for the entire design life of the building.

The **Philosophy** of the response may be a combination of technocentric (technology based), deterministic (human action and management) or ecocentric (bio-climatic based) approaches.

7.1.8 Review

Any changes to previously agreed sustainability risk management strategies during the design development process are noted with a date and initials to allow a record to be kept at each review stage.

Review	
Revision notes	**Residual Risks and responsible party**
Insert date and initials	Further action or management system required in use

Figure 7-6 Identifying revisions and residual risks

Residual risks are identified during the project and are confirmed at completion. Opportunities for further work, or any items that were omitted would be noted at this stage to aid the facility management to fully understand what the building was designed to achieve and how it should be further monitored and managed.

7.1.9 Facilitation within the design process

The SRM Matrix has been developed to be as flexible as possible in terms of when it is introduced in the design process. The ideal situation is that it is introduced at the inception stage as part of the briefing process. This allows the maximum benefit to be gained from the potential it offers to reduce environmental impact. The second ideal point to introduce the SRM Matrix is when developing the design scheme to meet planning requirements. At this point many design decisions are still to be made, and the setting of targets measurements is useful in defining the parameters of the proposal with the client. The matrix can equally be introduced by the contractor's design team at tender stage to address risks to sustainability that have been insufficiently mitigated or that are particularly pertinent to the contractual stages of the project such as site management and local environmental impact. This might even extend to value engineering for improved whole life costing and contractors of sub-contractors design for improving energy efficiency or more benign material specification. Even after the actual construction is complete, the same process could be implemented in facilities management to manage ongoing risks to sustainability and highlight ways to monitor and improve the building's performance and the management of the occupants and surroundings.

7.1.10 Guidelines for Implementation of the framework

During the course of the case studies of projects using the framework in chapter, it was found that design teams were very comfortable with the format of the framework, but depended on one person to manage the form. The following stages were noted as facilitating the use of the framework.

Appointment of Sustainability co-ordinator or manager (this would generally be an architect, technician or could be allied with Health and Safety co-ordination services or project management). This role would prompt the discussion of the issues and monitor criteria achievement at meetings. Minutes of related discussions are recorded with normal design team and client meeting minutes. Updated information would be presented to the client at agreed stages (for example RIBA plan of work stages or to coincide with key programme dates) including tender and at as part of the operations and maintenance manual information at handover.

The developed framework matrix, like any tool, can only be as good as the information put into it and the effectiveness and rigour with which it is managed. Early introduction is necessary to maximise potential gains form its use. The responsible person must be suitably briefed and trained to manage the SRM Matrix with confidence; this might be a project leader or a small team working together. Interest must be solicited from the retailer by presentation of the ranked mitigating actions for selection and most critically, their policy and performance criteria be obtained in order that the design team can work together to understand the risks to sustainability that are relevant and important to the client and how they could be appropriately mitigated. Regular meetings are the best way to manage this process, but equally, web based systems and e-mail circulation can also be effective.

The most important aspect of managing the matrix is to understand that it is to be used in the way that suits the project and client aspirations, so it should provoke as well as conclude on discussion. Headings for sustainability risks should be added or omitted depending on the scope of the design brief. Where something is outside of the scope and limitations of the project design it should be noted as such, or remain highlighted as a question until the last opportunity for change in the design has passed.

Key criteria are likely to arise over a number of repetitions. These might include such criteria as kWh or CO_2 per m^2, percentage of energy generated from micro-generation, or water obtained through rain collection. Using a numerical criteria or sustainability indexing such as retail sustainability index using Langston and Ding's sustainability index (2001) outlined in chapter 5 might allow performance improvement to be demonstrated in a roll-out programme for a single client. As energy use is likely to be a significant part of the Sustainable Building Code in the future, this is not a key role of the framework; other mechanisms will allow these comparisons to be made.

Over time it might become apparent that there are increasingly more levels of profundity available as more technological solutions to particular problems are marketed. It should also become apparent that the level of passivity is gradually being elevated by new or upgraded legislation whilst at the same time, industry leadership extends. This should be an evolutionary process which demonstrates the principle of continuous improvement being met. How fast this happens will depend on how eager retailers become to take the lead and how fast the construction industry and building product market respond.

7.2 Live case studies

7.2.1 Aim, objectives and anticipated outcomes

The aim of this evaluation was to demonstrate the design methodology framework in operation. Testing the design methodology framework using real data in the form of an active project) can provide an understanding of how the method is received and used by stakeholders and feedback to develop the framework for ease of comprehension, and applicability to different projects. Such case study testing would develop a narrative content where the framework supported design decisions or changed maintenance or use policy. The views of clients and construction professionals involved in case studies subject to modification during the course of the research might demonstrate how effective the design methodology is considered to be for identifying sustainability risk and providing options for mitigating that risk, and the extent to which the projects are made more sustainable. The objectives were therefore to demonstrate examples of the SRM Matrix in use in retail projects and attempt to ascertain what impact the SRM Matrix had and what interventions were introduced as a result. It was anticipated that the projects would have an improved social and environmental impact with the economic impact remaining as the retailers required for the development to remain feasible.

7.2.2 Research methodology

The two case studies used here represent two retail projects that were ongoing at the point at which the iterative development cycle of the research described in chapter 6 was ceased to commence an implementation phase, that is to say that the iterations were no longer prompting modifications to the design methodology framework, but rather were leading to observations in its successful implementation.

Implementation on each project followed the following stages;

1. Identify project and approach project leader
2. Introduce framework to project leader/design team
3. Allow period of project ownership

4. Obtain feedback using design criteria as a basis for discussion.

Demonstrating to what extent the design methodology framework had in identifying alternative options to the retailer or developer is not straightforward and can only be captured by involvement in discussion and decision making processes, which are not necessarily available to the researcher. It is also possible that the design methodology framework is supporting the recording of decision making and documentation of targets other factors in an ongoing project where such discussion may be otherwise not formally recorded. Any form of benchmarking, interview or survey during the course of the live case study projects may not provide useful feedback due to limitations of a design brief as yet unfixed and consequently any targets are yet to be met, therefore the findings are based on more subjective observations rather than a scientific method of evaluation.

Live Case Study 1: Mixed use Retail Development 2005 (ongoing)

This 20,000m^2 retail development for a developer has employed the SRM Matrix (Appendix V) from the feasibility stage, but the project is still very much in design stages after two years. The development includes a number of building uses, predominantly retail, a cinema, public toilets, external landscaping and large multi-storey car park and 140 residential units, partly on upper floors and partly free standing, which are to be developed by a second developer. The site was an area of brownfield land in a sizeable market town. The SRM Matrix had been used to identify that the project was suitable for combined heat and power (CHP) due to the mix of commercial and residential units however this had not been expected to be selected by the client as it was seen as an industry leading solution.

The planning application was submitted without a sustainability statement or environmental impact assessment being required by the planning officers. Shortly after the submission was made, the local Member of Parliament became aware of the proposals due to correspondence from town residents. The question of using CHP for the scheme was raised by a member of the public and the planning office promptly requested a new application be made with further supporting information. The developer was forced to review the opportunities for installing CHP on the site and with an energy consultant found that whilst the below ground infrastructure could be accommodated for later installation of the plant, there were a number of logistical difficulties. Firstly the major commercial tenants that were already committed (two anchor department stores and the cinema) would be unlikely to agree to this change of electricity source. Secondly the electrical output of the CHP plant could not be calculated without negotiation with a number of parties. To be successful the district heating potential would need to be based on domestic hot water needs for all residential units and also for the sanitation in the commercial units. To optimise the electricity generation, it would also be necessary to assume that retailers could use the hot water in absorption chilling (Tri-generation).The retail services design would not be at a stage to calculate this usage for some time, and therefore needed to be assumed or a commitment agreed, both of which could prove to be inaccurate. Thirdly, the management and billing could not be carried out by the developer as they did not at any point own the site and were not agreeable to taking on the risk of developing CHP the system to sell or let as this was an unknown market based mainly on a precedent of charitable Energy Service Companies (ESCO) for larger schemes. Alternatives might be that the local authority who did own the site might wish to manage the system, or the housing developer who would remain as the manager of the housing could also take this on as a business opportunity. The outcome of this situation is yet to be confirmed, but it is anticipated that the developer will be forced down this route by another issue. The assessment of the project for AD Part L2A (National Calculation Methodology or SBeM) requires that the tenants' fit outs (subject to the tenants' own applications for Part L2B) assume the worst case scenario, or that the commercial tenants only just pass Building Control requirements and that they use air conditioning. The cumulative effect of this may require that the developer is required to provide Low to Zero Carbon technologies (LZC) of which CHP would be the most effective at saving CO_2.

The developer was forced to make a commitment to gain BREEAM Excellent and Ecohomes Excellent ratings at planning the stage. The initial findings of the BREEAM assessor showed that this was not going to present many significant challenges if the tenants' energy use and fit out were eliminated from the assessment. This was mostly due to the nature of the site and the developer and contractor's excellent internal environmental a social responsibility programmes. The developers response was to install the below ground infrastructure for the CHP distribution network and investigate the management possibilities. In most other respects the active response is taken, which should result in a more sustainable scheme. Yet to be established is how well the tenant retailers will respond these ideas.

Project ownership of the SRM Matrix has not proved successful in this case as the developers team are highly suspicious of cost implications and making claims at planning stages that cannot be achieved and the design team are not confident in the role of managing the SRM Matrix. The carbon footprint calculation required by the developer is also problematic due to the difficulties in understanding what the retailers and other tenants hope to achieve. Again the approach taken is to assume the worst case for all of the commercial tenants, the development should have a total energy use of 74 kWh/m^2/year including car parks. This equates to 1480 kg CO_2/m^2/year. Two of the retail tenants are now expected to be reducing their energy load from the design calculations used in these assumptions although the exact saving will not be declared until both retailers have made their Part L2B submissions. Assuming that the construction of the project will follow a typical pattern the construction phase, including embodied energy, construction fuel and transport will be in the region of 10,000 tonnes of CO_2 or 510 kg CO_2/m^2 however, this has not been modelled and will require monitoring (which will also have the benefit of gaining BREEAM credits) during the course of the construction phase.

Live Case Study 2: Shell for stand alone department store (fit-out by others)

This store is located on a piece of semi-brown field industrial land beside a motorway intersection. There are other comparison goods retail uses locally and a supermarket, but the site is on the edge of a town with reasonable provision of public transport provided by bus. It is being developed by a developer in close communication with the end user.

The retailer has outlined energy saving targets and other environmental initiatives they would wish to incorporate in the store, but have found that discussion with developers very often comes too late to allow these initiatives to be incorporated and hope that this scheme will be better managed by integrating the design development with the retail implementation team, and concept designers and the shell developer.

The introduction of an SRM Matrix (Appendix VI) occurred as the developer started to consider the retailers new brief to include enhanced sustainability.

The stand alone shell has parking for 630 cars and provides 180,000sqft over two floors. The SRM Matrix has been completed for the initial scheme design and has identified that a feasibility study is required to assess which of the energy strategies and associated heating and cooling methods would be the best option for the retailer. The developer has identified that there is an opportunity to provide roof lighting, but this needs careful design for maintenance safety, avoidance of solar gain and night time light pollution. The shell fabric also is required to be low environmental impact and embodied energy which may pose financial and insurance risks. This project is at early stages and a period of project ownership has not yet been established.

In order to address with the financial implications of this new brief, three parallel schemes have been developed, a baseline scheme that represents what would have been built had the retailer continued along the conventional route provided b the retailer, a concept scheme which incorporated a number of innovative and less well established technologies in retail architecture provided by a concept architect, and a scheme which addressed the ideas in the concept scheme and ensured that the procurement programme, and costs were managed alongside less radical technologies that met the retail brief with some compromise to all the considerations of social, environmental and economic sustainability provided with the knowledge of the retailer, retail fit-out contractors, the shell contractor and the input of the concept architect. The SRM Matrix was invaluable in identifying the middle ground between the passive solutions in the conventional scheme, the industry leadership solutions in the concept scheme and the options between those two extremes that would form the actual building that would be developed.

7.2.3 Findings

These two live case studies have justified the use of the SRM Matrix on four grounds;

1. In identifying alternative mitigating strategies and ranking those in order of effort required (or *profundity*) for the benefit of the decision making party (whether developer, retailer or procurement team working together)

2. In identifying the issues surrounding sustainability in a project, and keeping those issues apparent during the development stages, particularly where the brief is changing due to forces within and outside of he control of the building procurer.
3. In defining targets for the performance of the project including the *philosophy* of the solutions selected.
4. In determining where responsibilities lie between developer and tenant and their various consultants in terms of cost, ongoing management or demonstration of meeting targets set within the team or by external bodies such as Building Control or Planning authorities.

7.3 Evaluation of Sustainability in Retail Architecture

7.3.1 Aim, objectives and anticipated outcomes

The aim of this evaluation study was to assess the potential effectiveness of the sustainability risk management matrix in the design and procurement of a more sustainable solution for a range of retail project types and clients. The same retail forms are used as previous simulation studies in chapter 4.

The objectives were;

1. To investigate opportunities in hypothetical retail projects using the SRM Matrix without the programme and cost limitations of live test case studies.
2. To evaluate how effectively the SRM Matrix has met the design criteria set out in chapter 6 for the design framework methodology.
3. To identify the improvements to sustainability in retail architecture that could be delivered by using the SRM Matrix.

The anticipated outcome was a demonstration of the possibilities for sustainability highlighted by the utilisation of the SRM matrix and what situations might trigger these interventions.

7.3.2 Research methodology

Four hypothetical retail projects detailed in chapter 4 as representative of the range of retail work being carried out in the current economic climate in the UK and providing a representative mixture of retail forms were used to provide a control group for *time series analysis* (O'Leary, 2004). The SRM Matrix was then put in place for these hypothetical examples to demonstrate what risks to sustainability are posed by the project, the ranked options for mitigating the risk and which the client might choose. This methodology follows the *process of implementation* outlined by Coghlan and Brannick (2001); determine the need for change, determine the outcome if no change, determine what needs to be changed, manage the change. This process was introduced as the process of change in Chapter 1 (figure 1-7). The risks to sustainability identified are not unique to each but represent the most significant issues established by experience in retail architecture and from the literature likely to be brought to discussion and how the notional client might respond to mitigate the risks.

The difficulty that can be established with using simulated data for summative evaluation is the lack of objectivity and control in the analysis. It should be noted that only two live cases of implementation in retail projects have been established during the research period had others been available, a wider selection would have been made. Both live projects are ongoing projects which render conclusions drawn from the application of the SRM Matrix difficult to replicate as at any stage, reversal of decisions made by the client could occur for any number of reasons and the baseline condition (or passive approach) be reverted to. Bearing this instability in mind, the use of simulation becomes favourable in demonstrating what could be achieved in the overall aim of improving the significance of sustainability in retail architecture.

Testing the SRM Matrix through simulation requires the use of simulation or historic data and analysis by the author to identify the strengths and weaknesses of the proposed framework. This process is then iterated further to test the framework using conjectural alternative solutions to a project brief to form a theoretical time series analysis investigation. The following list of actions and Figure 7-7 describes the tactic;

1. Obtain historical data for a typical project

2. Utilize framework
3. Analyse using design criteria
4. Simulate a hypothetical project (a narrative is used to outline a hypothetical case study)
5. Analyse using design criteria

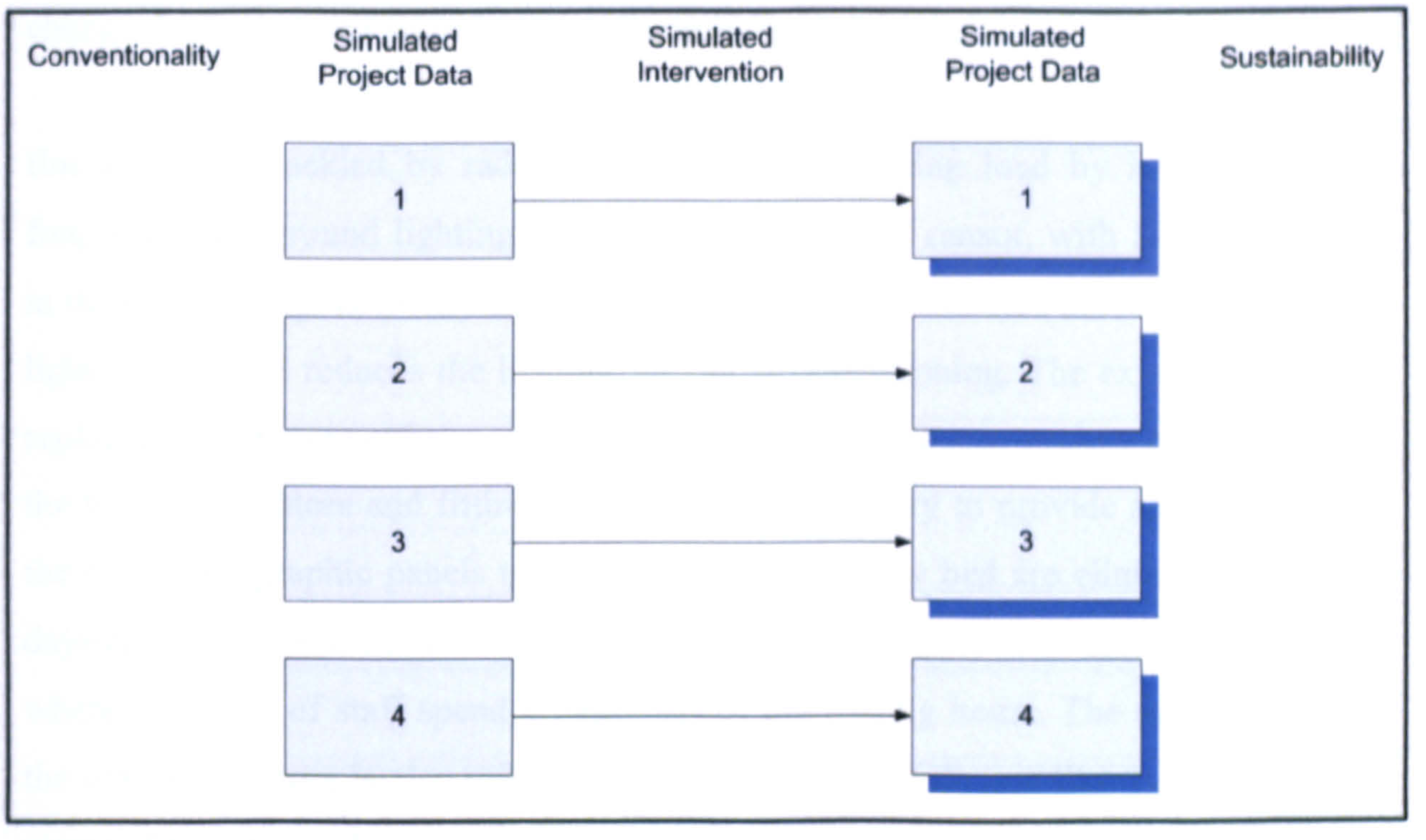


Figure 7-7 Time series analysis

7.3.3 Simulation; Small Quality Fashion Retailer

Located in a high street, this tenant retailer can expect to have an existing operational air-conditioning system, existing small kitchen area, toilet facility and associated drainage. The building fabric might by current standards be considered thermally poor, and windows and shop frontage is likely to be single glazed. It is assumed that the existing air-conditioning is tested and any maintenance or modifications such as CFC refrigerants eliminated necessary to meet legal requirements carried out, and welfare facilities are upgraded to meet current regulations. The maintenance of the rest of the fabric is the responsibility of the landlord. A new lighting scheme will be developed with a lighting consultant (or suppliers designer), and the remainder of the fit out will follow the standard details set out by the concept designer. The fixtures are assumed to be fixed lacquered wooden shelving, flooring is a PVC based tile and walls and ceiling painted plasterboard.

The retailer makes a decision to try to take an active approach to reducing environmental impact, but they are not keen to have any impact on their economic performance as a result. Identifying the major risks to sustainability inherent in the scheme, energy use, environmental impact of materials, water and waste management the SRM Matrix allows the design team to make recommendations to the client to change the design and specification of a number of elements.

Energy use is tackled by radically reducing the lighting load by integrating high frequency background lighting controlled on a daylight sensor, with LED spot lights in the same fittings normally used for display areas. This reduces the heat given off by light fittings and reduces the loading for the air-conditioning. The existing system is replaced with a more efficient model which can use air-source cooling concentrated at the back of the store and fitting rooms and heat recovery to provide an air curtain at the door. The graphic panels to the back of the window bed are eliminated to allow daylight penetration into the first bay of the store, where the cash desk is located and where members of staff spend a large part of the trading hours. The sash window at the rear of the store is also utilised for daylight, but translucent film is used to avoid views of the backs of neighbouring properties. Investigations into the existing glazing do not support provision of replacement double glazing in the traditional timber windows.

The materials and finishes are checked against Anderson and Shears (2002) ratings and substituted for "A" rated products, most of which are comparable in price to the original specification and are approved by the retailer and concept designer. Timber is specified as FSC grade and a UK source is found for the veneer to the shelving. The PVC flooring is replaced with a marmoleum and low VOC Paints are selected. Water use is tackled by fitting flow restrictors to the taps and reducing capacity of the WC cistern. A hot water dispenser is fitted in the kitchen and WC to eliminate run-off of water from the hot water tank.

The contractor signs up the Considerate Constructors scheme as there are a number of issues with hoardings, noise and access. Because there is only space in the rear yard of the store for one small skip, a waste management company is used to separate the materials at a depot and parts the previous finishes are recycled. The store receives two large deliveries of stock each season and does not have space to store packaging waste. Instead a waste is management contractor removes plastics and cardboard weekly together with some neighbouring stores and the cost is shared. House hold waste is vastly reduced as a result and employees take their own lunch time packaging waste to home to domestic recycling provisions. In order to manage long term energy waste and water management, the store's employees are trained in facilities management procedures and are encouraged to be pro-active in a bonus related store performance scheme. The retailer includes information about the new store and their achievements on their website.

Key data	Conventional Project (simulation)	After Intervention with SRM Matrix (simulation)
Cost per m^2	£900	£900
Area	180	180
Kg CO_2/m^2/year	150	60
Interior Materials specification	Standard lining materials	A rating/recycled content, low VOC coatings
Fixtures	Fixed quality joinery	Fixed quality joinery (FSC), low VOC coatings
Water management	To meet legal requirements	30% reduction
Waste management	Local Authority town centre collection	Packaging separated and removed by waste management contractor
Construction waste management	Single skip	Waste management contractor skip
Facilities management	Not employed	Store targets reflected in staff bonus
Dissemination	Not employed	Web site updated

Figure 7-8 Time series analysis based on simulated data for small quality fashion retailer

It can be seen that the most important first stage is the desire of the retailer to improve environmental performance, but there would be a number of secondary improvements for employee wellbeing and loyalty, and the dissemination of the achievements may have a positive effect on custom. Keeping the capital cost within the budget may be challenging to the design team, particularly in respect to the replacement of the air-conditioning system and the more expensive LED lamps, however the lamps could be supplied by the retailer as they are guaranteed to last years rather than a few months in the case of many halogen spot lamps, saving the store manager the difficulties of replacing lamps around visual merchandising in window displays.

7.3.4 Mid-sized Low quality fashion retailer

Situated in a new retail terrace this retail unit is a large volume of space with a mezzanine floor inserted with a new lift, this makes up a large proportion of the capital cost but is partly funded by the landlord. The shell is not highly insulated, and the retailer installs a shop-front with a roller shutter for security and no lobby or doors during trading hours. The finishes are a variety of PVC floor tiles and carpet tiles used to delineate mini-departments within the store. The walls are re-enforced with timber battens and painted to carry a lining and shelving system which covers most of the wall area. The panels of the shelf lining system have a sprayed speckled metallic paint finish that must be batched to ensure even colour. Shop front windows are obscured by graphics film and backed with racking to maximise the stock levels on the sales floor. The ceiling is painted dark grey with services exposed and painted to match. The lighting scheme uses high powered spot lighting and high frequency background lighting which gives off a great deal of heat. Staff facilities are basic, but busy with showers, lockers and a lunch area. The store has a daily early morning delivery to replenish stock, as only shoes are stored off the sales floor, and all packaging is returned in the caged delivery trolleys overnight to the distribution centre for recycling. The standard details provide for significant timber rail wall and steel door protection due to high levels of impact damage due to the stock delivery method. The budget is very tight at £400 per m^2 and the contractor must perform very efficiently to make a profit for this client. The retailer has accepted that they must meet Part L2B, but cannot anticipate performing better than that level on energy efficiency.

Using the SRM Matrix, the design team set out the opportunities for improving the performance of the building in the knowledge that much of their suggestions will be beyond the retailer's requirements. The main risks are again energy use, waste management, water management and maintenance. Energy management is tackled by upgrading external walls and roof with thermal linings preventing excessive heat build up in the summer and losses in winter these linings incorporate the battens required for fixing the system racking and lighting. The lighting scheme is reviewed to introduce alternative lights and the ceiling is painted white to increase reflectivity. The entrance design is radically changed to introduce sliding auto doors and a lobbied area the same size as the security tag sensor zone to ensure no trading area is lost. This buffer zone saves considerable energy in seasonal heating and cooling requirements alongside the reduction in lighting heat gain. The cooling system is then replaced with a heat exchange and ventilation system which responds to the customers likely clothing level for the season rather than a fixed temperature all year round and staff are issued with an additional optional layer of uniform. The shop front area is limited, but glazing is left open to allow some daylight penetration, this allows a view into the store and non-standard and seasonal merchandise offers are displayed on benches. The retail terrace has a walkway canopy so no solar gain problems are experienced.

The materials are checked against the Anderson and Shiers (2002) and reduced impact replacements are found, but they are more expensive. The retailer agrees to trade off between several types of flooring as a trial for future stores. The racking system remains because but the coating specification is changed to a standard colour reference to allow a local company to re-spray scratched panels without obvious colour differences. The landlord allows WC flushing water to be stored in small high level tanks from one internal rainwater down pipe in the unit which allows variable savings in water use, the fittings already provided a low water usage and a token system is installed for the electric showers limiting the volume of water available for staff showering, those who cycle to work are rewarded with additional tokens. Provision of a solar thermal water heating system are discussed, but space for water tanks is limited and roof orientation is not ideal.

Because much of the waste was already dealt with by the removal in the stock delivery lorry, cans bottles and wrappers from staff lunches are separated in the staff kitchen and duty rota set up to take these to the separate skips provided by the landlord. Maintenance issues are tackled with some design changes to wall protection and door manufacture in the delivery routes these are more expensive, but the client accepts these costs as they are not significant in the overall cost of the project.

Key data	Conventional Project (simulation)	After Intervention with SRM Matrix (simulation)
Cost per m^2	£400	£410
Area	500	180
Kg CO_2/m^2/year	200	125
Interior Materials specification	Standard lining materials	A rating/recycled content, low VOC coatings
Fixtures	Coated metal System	Coated metal system
Water management	To meet legal requirements	30% reduction
Waste management	Local Authority paladin collection and take back scheme	Take back scheme extended all other waste separated in store
Construction waste management	Separated skips	No change
Facilities management	Minimal	Store targets reflected in staff bonus
Dissemination	Not employed	Web site updated

Figure 7-9 Time base analysis simulation for a mid sized low cost fashion retailer

The retailer saves more energy than expected and the running costs are dramatically reduced. The interventions are rolled into the next store which implements further flooring specification changes, however the building regulations lag has caught up and the shell thermal performance and air tightness are of a standard that mean the thermal lining need not be carried out. The retailer gains extensive press coverage for being the first retailer in this sector to carry out such measures in stores.

7.3.5 Department Store Fit out

This project forms a large and complex store with multiple concessions installed by other contractors within the unit, Design programme of two years and site programme of 40 weeks using a Design and Build contract of a value in the region of £5 million. Landlord's site works are ongoing with a number of other retail and restaurant tenancies. The store is part of a new mall that is not air-conditioned, and the doors onto the mall are roller shutter type. External doors and shop fronts have been installed by the landlord and are good quality double glazed metal framed units. An atrium roof light provides day-lighting to the main circulation area and the staff welfare areas have good provision of daylight.

The interior scheme uses a variety of ceramic and vinyl flooring types, painted and timber laminated doors, painted plasterboard walls and vast quantities of MDF in partitioning and display system concealment panels. Standard details are used for a number of areas to create more interesting settings such wedding wear, cosmetics and sportswear and there is a customer café and restaurant as well as extensive staff welfare facilities, offices, storage and security suites. Each of these areas has further standard details and finishes.

The retailer has expressed a desire to position the brand ahead of other department stores in terms of environmental and social impact. Many social impact schemes are already in place, including setting up links with local charities and schools for employee volunteering opportunities. This is a large organisation and the human resources team work hard to provide a good service and expect loyalty and performance in return. The environmental credentials of the retailer have been put in focus by ADL2B and media highlighting claims of use of non- FSC grade timber.

The design team implement the SRM Matrix and split sustainability risks with each area of the scheme as well as overall energy, material impacts, waste and water use. Reducing the lighting and air-conditioning load can offer considerable savings in running costs. The pro-active response to this risk involves the introduction of solar micro-generation capacity on the large roof area and would require co-operation from the landlord, and the local planning authority, which considerably increases the time and cost involved. The amount of energy achievable is unlikely to meet more that 5% of that the total load requirement and the capital cost of the system and the anticipated pay back period would render this solution unlikely to be accepted, but tax incentives or grants available in the future could allow later installation. The Industry leadership response of a wind turbine requires input into the landlord's scheme at a very early stage, and this situation cannot be expected to be reached where the shell buildings are already substantially underway. The active response is selected and the scheme design will be the responsibility of the lighting consultant and long term management by the store facilities manager. Its futurity will extend to the first major refurbishment likely in 5 to15 years.

Key data	Conventional Project (simulation)	After intervention with SRM Matrix (simulation)
Cost per m^2	£700	£720
Area	120,000	120,000
Kg CO_2/m^2/year	200	80
Interior Materials specification	Standard lining materials	A rating/recycled content, low VOC coatings
Fixtures	Concealed painted MDF system	Concealed painted MDF system
Water management	To meet legal requirements	30% reduction
Waste management	Single large compactor	Landlord installed recycling centre
Construction waste management	Separated skips	Design to reduce site waste
Facilities management	Dedicated team	Dedicated team with VM integration
Dissemination	Not employed	Join BITC CSR index scheme

Figure 7-10 Time base analysis simulation for a department store fit out

The specification and standard details are reviewed to ensure materials are low impact and minimise construction waste by changing cutting sizes to maximise sheet material usage. Flooring is selected based on the potential for recycling the products after five to ten years when it is expected to be replaced and walkways relocated. Most painted door leaves are upgraded to laminate to save on maintenance costs and the fixing details changed to allow ease of relocation. The ceiling tile specification is changed to a recycled product.

The store has a number of public toilet facilities, staff facilities including showers and three catering facilities; therefore water use is quite high. The developer's drainage system is already installed under warranty making any modifications almost impossible to insure. The risk is mitigated by installation of low use fittings and waterless urinals. The solution is dependant on technology for success, and the scheme design would be the joint responsibility of the architect and services consultant and the facilities manager will be responsible for the long term management of water efficiency and calculation of year on year savings on mains supply.

The active response to waste management may initially generate some income and save on land fill tax by separating and trading packaging waste on site, however at a late stage in the project, the landlord is compelled by the local authority and tenant demand to set up a recycling area for all tenants to facilitate separated collections and to minimise the number of vehicles involved. The space for the compactor must be used for smaller receptacles to stand and be taken by fork lift to the main collection point. The contractor manages site waste and energy use in a very comprehensive manner and the concession sub-contractors are required to do the same.

As a result of using the SRM Matrix, the client achieves their requirement to position the brand and decides to enter the BiTC CSR reporting index and considers BREEAM Assessment for the next project using the experience of the project to enter into early discussions with the landlord to achieve the strategies that could not be achieved due to the shell works being so far advanced.

7.3.6 Retail Development Shell

The project includes a number of retail uses, hot food outlets, a cinema, public toilets, housing and a management suite. The scheme would anticipate some negotiation being required with the local authority to obtain permission.

The development uses brown field site in a small town and has a wide variety of sizes of unit, and building envelope materials. The design of the scheme has required extensive discussion with planning authorities and other bodies to ensure the urban scale and form, design quality and visual amenity are suitable. The developer is required to support the tenants in meeting Part L2B of the building regulations and must provide a well sealed thermal envelope. Value engineering is a vital part of this project, as the scheme must stay within budget to remain feasible.

The planning authority have already established the need for retail and employment impact assessment, a green travel plan and environmental and ecology impact report for the site. They also require a sustainability statement and the developer is keen to win planning approval without jeopardising the feasibility of the scheme.

Key data	Conventional Project (simulation)	After Intervention with SRM Matrix (simulation)
Cost per m^2	£1000	£1000
Area	300,000	300,000
Kg CO_2/m^2/year	50-100 in shell areas	20 in shell areas
Exterior Materials specification	Standard materials	Low impact materials recycled content, local materials
Interior Materials specification	By tenants	By tenants
Landscaping	Standard scheme	Biodiversity scheme
Water management	To meet legal requirements	30% reduction
Waste management	Tenants' compactors	Recycling storage areas
Construction waste management	Separated skips	Design to reduce site waste
Facilities management	management team	Emphasis on communication
Dissemination	Not employed	Encourage tenants into an active approach

Figure 7-11 Time base analysis simulation for a retail shell development

Because the anchor tenant have yet to sign agreements to lease, the developer works with the sustainability and store development team of each retailer to establish the energy use strategy and loads for each tenancy, and where necessary modifying the shell specification to suit specific cooling regimes such as night purging heavyweight floor slabs, opportunities to temper incoming ventilation air through substructure and use of heat pumps and heat recovery. In return for this benefit, the retailers make a commitment to their energy use which can be incorporated into the overall shell AD L2A assessment and demonstrating very good energy savings. The developer is surprised to find that rather than a competitive and secretive atmosphere, the various consultants and facilities managers gain great benefits from such cooperative working and develop a community of practice to ensure that future retail developments work towards zero carbon. The retailers also benefit from the excellent media attention, and are keen to part of the next development.

This project required a level of trust and belief by the developer that retailers really wanted to be part of a more sustainable scheme and not be scared away by lease term which required commitments to cap energy use. A situation which reflects Barrett's (1998) absence of fear principle.

7.3.7 Summary of findings

This investigation has demonstrated that a variety of decisions can be made based on a variety of external forces and internal criteria. This evaluation investigation can only provide an approximation of how the introduction of the SRM Matrix might affect the retail facilities that are developed. This evaluation could be seen as speculation of a possible future rather than a determinable one. It is only possible to understand the full implications of the decision making procedure when it is used for live projects where many factors could affect the actual project outcome over a long span of time.

It can be seen that the information that can be managed in the SRM Matrix format can be made to suit the scope and limitations of the project exactly. It cannot be determined if the resulting projects would be more sustainable, but the management of the process of mitigating these sustainability risks must surely help to promote and rationalize their introduction into the design process. It could however be assumed that there is a need for background knowledge and understanding of sustainable design and that a number of the team members involved must be prepared to lead the changes to the fabric and services design. The forces that trigger the change may be legislative, business risks of consumer demand or competition from rivals or lead by management transformation, and may often be a combination of all of these.

7.4 Evaluation of the Design Methodology Framework

7.4.1 Aim, objectives and anticipated outcomes

The aim of this section was to assess the effectiveness of proposed SRM Matrix as an addition to the design process for facilitating the provision of more sustainable retail facilities. The objectives were;

1. To ensure the working proposal design framework methodology meets the criteria set established by the literature review and investigations in chapters 2
2. To ensure the working proposal design framework methodology meets the design criteria summarized in chapter 6.

7.4.2 Research methodology

A number of practitioners were invited to attend a presentation of the SRM Matrix methodology which included one example completed SRM Matrix and asked to complete a questionnaire following a discussion at the end of the session. The survey and the presentation was also issued to forty invitees selected from participants and collaborators involved in the design methodology framework development in chapter six and their immediate colleagues. The attendees provided feedback in the form of the questionnaire, and discussion during the presentation and delivered shortly afterwards allowing both broad and in depth information to be gathered (Groat & Wang, 2002). The questionnaire was limited to two pages of 18 questions using a ranked scale or yes/no answers and some open ended questions. The first page was completed before the presentation to gauge the respondents' general experience and understanding of environmental evaluation tools and sustainability. A pilot questionnaire was submitted to an Architectural technician who participated in the case studies in chapter six which supported the clarity of questioning.

7.4.3 Questionnaire results

The results of the survey are described and discussed by subject groupings and a summary of findings concludes the section. The data matrix is to be found in the appendix.

Respondent information

The attendees were a range of 14 architectural job runners, key client account managers, contract managers and developers with a range of levels of experience including one interior designer specialising in retail architecture and four architects and architectural technicians with more than 10 years each of experience in retail architecture. Two of the attendees have had working experience of the SRM Matrix due to involvement in two of the case studies used in chapter six.

	Retail Experience	Other sectors
Architects	2 (14%)	3 (21.5%)
Architectural Technicians	2 (14%)	3 (21.5)
Interior Designers	1 (7%)	0
Contract managers with retail experience	1 (7%)	1 (7%)
Environmental Construction Consultant	0	1 (7%)

Figure 7-12 Questionnaire respondents

Previous experience of sustainability design and assessment

The respondents were asked which of the following assessment methodologies they had project experience of. This demonstrates that there is a reasonable level of knowledge of other environmental assessment methodologies. Nine of the fourteen felt that they had a good understanding of Sustainable Design, two were not sure and three did not feel they had a good understanding.

General understanding of the SRM Matrix criteria and methodology

In order to establish the effectiveness of the proposal for simplicity, legibility and accessibility, respondents were asked how well they understood the methodology of sustainability risk management on a scale of one to five. The proposal attained a rating of 54 out of a total score of 70 or 77%. This would suggest that the matrix was reasonably self-explanatory, however as none of the questionnaires that had not received an explanative presentation of the framework had responded this cannot be assumed. The respondents were asked to rate how well all the issues of sustainable design were incorporated in the structure of the framework proposal and the overall rating was 48 out of 70 or 68.6%.

	Yes	No	Not Sure
Sustainability Statements	3 (21%)	8 (57%)	3 (21.5%)
BREEAM Assessment	4 (28%)	10 (72%)	0
Energy use calculations or SBEM	2 (14%)	12 (86%)	0
Whole Life Costing	5 (36%)	9 (64%)	0

Figure 7-13 respondents experience of environmental evaluation tools

Sustainability Risks

The respondents were asked to rate how effectively the sustainability risk headings would be at prompting design team and client discussion. The overall rating was 52 out of 70 or 74.3%.

Profundity

The respondents were asked to rate how effectively the ranked *proposed actions* would promote discussion with the clients. The overall ranking was 50 out of 70 or 71.4%.

Related Issues

The respondents were asked to rate how effectively the related issues allow interconnectivity of design decisions to be understood be the client and design team. The overall rating was 45 out of 70 or 64.3%. They were also asked to rank how effective this part of the matrix was for highlighting potential conflicts, and this resulted in an overall score of 46 out of 70 or 65.7%.

Design Checks

The respondents ranked assigning target measurements to each risk as 68.6% effective, period off effect as 74.3% effective and philosophy as 70% effective.

Review

As a method of tracking changing client requirements and design direction during the course of a project, the respondents ranked the proposal 70% effective. As an aid to facilities management the respondents ranked the proposal as 67.2% effective.

Perceived benefits of implementation

The following comments are taken from the questionnaire as the benefits anticipated by each individual implementing the SRM Matrix in their own projects;

- *clients awareness in importance of SRM matrix*
- *public awareness long/short term financial gain*
- *highlighting issues structure for review/discussion/implementation*
- *incorporating client knowledge of the environmental issues*
- *recording decisions made and why they have been implemented or discounted.*
- *financial savings and green efficiency*
- *implementation can establish some key principles at design stages*
- *reduce clients WLC, reduce environmental impact, good marketing for the Group and clients*
- *aid in determining a clearer brief from the client in what they want to achieve*
- *audit trail, client involvement, back up to policy*
- *customer focused, improvements from job to job*
- *improve local authority dialog*
- *marketing with local authorities, satisfying CABE or equivalent, marketing for tenants or funds lifecycle costing*
- *demonstrating CSR of Simons group*

Perceived barriers to implementation

The following comments are taken from the questionnaire as the barriers anticipated by each individual implementing the SRM Matrix in their own projects;

- *Nature of specific project*
- *Financial limitations* [to do more than the current passive approach]
- *costs perception*
- *lack of understanding of "cost" or life cost* [as opposed to the idea value discussed during the presentation]
- *knowledge of options*

- *client needs, clients may not know about available aspects so may not want to implement the unknown*
- *being able to establish benefit at design stage and comparing against capital/revenue expenditure*
- *clients not receptive designers can't be bothered*
- *limited knowledge*
- *understanding, costs*
- *knowledge*
- *lack of indication of potential cost benefits*
- *cost, difficult to indicate benefits, customers difficult to persuade*
- *perception of cost of implementation*

It can be readily concluded from the comments that the major barriers are cost and knowledge and ability of the design team to demonstrate the benefits of taking an active response to sustainability risks.

7.4.4 Discussions

The group assembled at the presentation focused on the triggers for individual clients proceeding from passive to active sustainability risk management particularly for environmental risks. Those that were interested in cost value and meeting performance targets (pre-transformational stages in Barrett, 1997) were unlikely to acknowledge a wider concept of value. This transformation point discussed in chapter three in respect to the corporate client is difficult to judge. It is unlikely to be triggered by the design team, but the design team might be in a position of forecast the approach of transformation by having a thorough understanding of the client's business, and accelerate the process with provision of information and support. Some of the attendees felt that their own clients were very far from being in the position of transformation, and found it difficult to see what the process might offer. However it was agreed that having a good knowledge of where the biggest risks lay in the client's operation would be helpful, primarily in energy use for compliance with AD L2A and L2B, and offering cost savings on waste water energy use. Other attendees could see that their client would soon be pushed into a change in practices by planning authorities and other stakeholders including brand competition with the retailers that are already making their commitments well publicised (Supermarket chains Tesco and Wal*mart were agreed to be the key examples of market led competitive transformation).

Many clients are thought to be very concerned with cost and pay back period. This could be seen as a passive approach, but having this set as a requirement within the framework would serve a valuable purpose of allowing the freedom to research alternative technologies or arrangement that might reduce impact without having an effect on cost.

7.4.5 Recommended Improvements

The questionnaire asked for possible ideas for improvements to the SRM Matrix to be given. The following points summarise the comments given and are followed by a response.

Content based comments

Providing specific SRM Matrices for a wider variety of retail projects to allow an initial project review to take place. This is an initial process that would lead to a base line for the SRM of future design projects to be improved or made more detailed. This comment was also required by those working in other sectors such as pharmaceuticals.

Providing options of headings of environmental considerations for specific requirements. The SRM Matrix was intended to have flexible headings for risks, this would set up for example a list to suit the requirements of planning authorities, or BREEAM. It was not intended that the list given was either exhaustive or that some risks might be ignored or "hidden" if they were not relevant. However, the list does act as a memory aid to the design team.

Making the matrix interactive with links to data sources and calculation tools on various websites, especially financial impact and up to date information on tax breaks. This supporting information would allow the design team to feel well equipped when discussing their client's measurements and targets. This would be useful for integration with Code for Sustainable Buildings and energy labelling.

Introducing case studies with energy or financial calculations to demonstrate cost savings or pay back periods for a variety of initiative to show to retailers. This would provide back up material to help clients to make an informed decision about a variety of mitigation initiatives that the design team might recommend.

By using colour to see at a glance how green and what is not fully mitigated. This recommendation would allow the design team to convey to the client and facilities management team where risk were still evident or potential for further improvement might lie.

Improving the simplicity of language used. This was highlighted by one respondent; it might be a reflection of respondents feeling overwhelmed with the terms developed by the criteria for sustainability or technical terms used in the matrices that were presented. However, the use of language is pertinent to how the form is received by the client. Attempts have been made in the development of the SRM Matrix to make the language appropriate to the audience. Further feedback must come from clients to understand the level that will suit the organisation and the design team may need to take a view on this with their own understanding of their client. Some clients may feel insulted by overly simplified language, others may be unlikely to respond well to the use of academic or technical language.

Process based comments

Increasing use in projects with experience of the design team to understand all of the issues and benefits for clients and further developing the SRM matrix. This comment highlights the limitations of the study period on availability of test case suitable projects. Further development with successive use of the SRM Matrix is intended.

Creating focus groups and knowledge bases for principle project types as a discussion forum and support network to implementing SRM in design and construction projects generally. This recommendation is not directed towards the content of the matrix, but towards its successful introduction into mainstream procedure not only retail and commercial projects but for all sectors of the business.

It can be seen that there is a need for background factual information, case studies and calculation tools to support the design team.

7.4.6 Summary of evaluation

This was a small sample, due to the requirement to include a discussion which allowed people to feel comfortable to express their views. It is apparent that there is a need to provide more background information and support for design teams to incorporate this framework into their project procedure successfully. Overall the proposal was ranked at 70% effective or between 3 and 4 on the ranking scale. It is difficult to expect practitioners to really judge the effectiveness of such a proposal without the benefit of utilisation on their own projects and through the design development process with their particular client's consultants and team. Knowledge of individual clients' projects and opinions regarding corporate responsibility may to some extent be reflected in the positivity afforded to the proposal.

The level to which the project team might promote the opportunities included would be very much dictated by the level of environmental consciousness of the individuals involved as well as that of the corporate client. This can in part be dictated by the corporate environmental consciousness of all of the individuals within the design team. The numbers of which that have passed a level of transformation would relate directly to the level of openness displayed in discussing the SRM Matrix in meetings. This multi-layered process of transformation is necessary to develop a more sustainable scheme design. It might be anticipated that a client intent on industry leadership would take actions for granted.

7.5 Recommendations for further development

This research limited the design development of the proposal to a working framework, which has been tested and developed with simulations and test cases.

7.5.1 Application

To provide a correlation assessment of the format, it would be necessary to show how a completed project performed without any intervention and how an identical project carried out simultaneously had an improved performance through use of the framework. This is problematic due to the uniqueness and brief and programming of projects and the difficulties of providing true control conditions. One proposal is it to survey stakeholders before and after intervention. Where a sufficient number of projects accumulated in the case study it may be possible to demonstrate averages of performance, however these would have no baseline to compare improvement against. It can only be identified that a project outcome is better in terms of sustainability than it might otherwise have been. As has been identified in chapter 5, there can be no perfect solution in terms of sustainability only elements and aspects of a project can be identified to be as good as is possible with current available technology or comprehension of an issue (this might be identified as a high profundity score) in the circumstances and availability of technology that a project can currently obtain or simply better that they might have been without intervention. As improved long term performance in terms of sustainability can only be estimated in that it is based on assumptions looking forward from the present, it would be difficult to prove that a building was in fact more sustainable in the long term. It can only be seen to have been better at the outset than it might otherwise have been. Elemental or specific issues could be correlated such as energy used per square metre or ratings produced by BRE or other bodies.

7.5.2 Interactivity

Further responses that have been brought into discussion since the presentation was made have suggested that the form be developed into an interactive web site with worksheets that are linked to each risk with a background to the issues, up to date legislation links, lists of recommended consultants, technology and suppliers, or policy suggestions for businesses. This may lead to possibilities to aid management of revisions within a project and uniformity of approach between projects. This recommendation would require dedicated website design and management to keep case studies and sources of information updated. This would also act as a knowledge gathering and sharing tool within an organisation.

7.5.3 Report format

One way in which the information held on the matrix is likely to be required to be disseminated is in a written sustainability statement document prepared for planning applications. Some local authorities may offer a list of headings to be developed, however, most do not offer specific guidance other than national guidelines, or BRE supported checklists (Brownhill and Roa, 2002). By using each risk as a sub-heading and describing the intended mitigation strategy, the document can be used to assemble a comprehensive report including targets and criteria where appropriate. Inclusion of the framework document as an appendix can allow the planning authority to understand this methodology and where necessary state parts of it in conditional approval documentation. Test cases in Chapter 6 have shown that this can be an important tool to the client or developer in ensuring levels of responsibility are maintained when leadership of a project is handed over.

Automatic generation of reports is not an advisable route to take as elimination of the thought and care which goes into the presentation of a project to stakeholders might be deleterious. The principles of the SRM Matrix require that each client and project is individually reviewed rather than taking a blanket policy approach.

7.5.4 Graphic presentation

Using colour to highlight significant parts of the matrix has been established by one of the test cases. This was initiated by the project leader to demonstrate the profundity of the client's chosen mitigation response. This allows a visual overview of the client's level of consciousness. A similar colour coding could be used to demonstrate levels of futurity and philosophy. If colour grading is implemented it needs to be explained within the matrix structure. Graphic presentation is often useful in reports and presentations. Whilst the intention of the framework is not to provide a presentation tool, it is easy to demonstrate the strengths and weaknesses of a projects proposed strategy. For example diagram below show how levels of profundity varies over the identified risk groups in a simulated project.

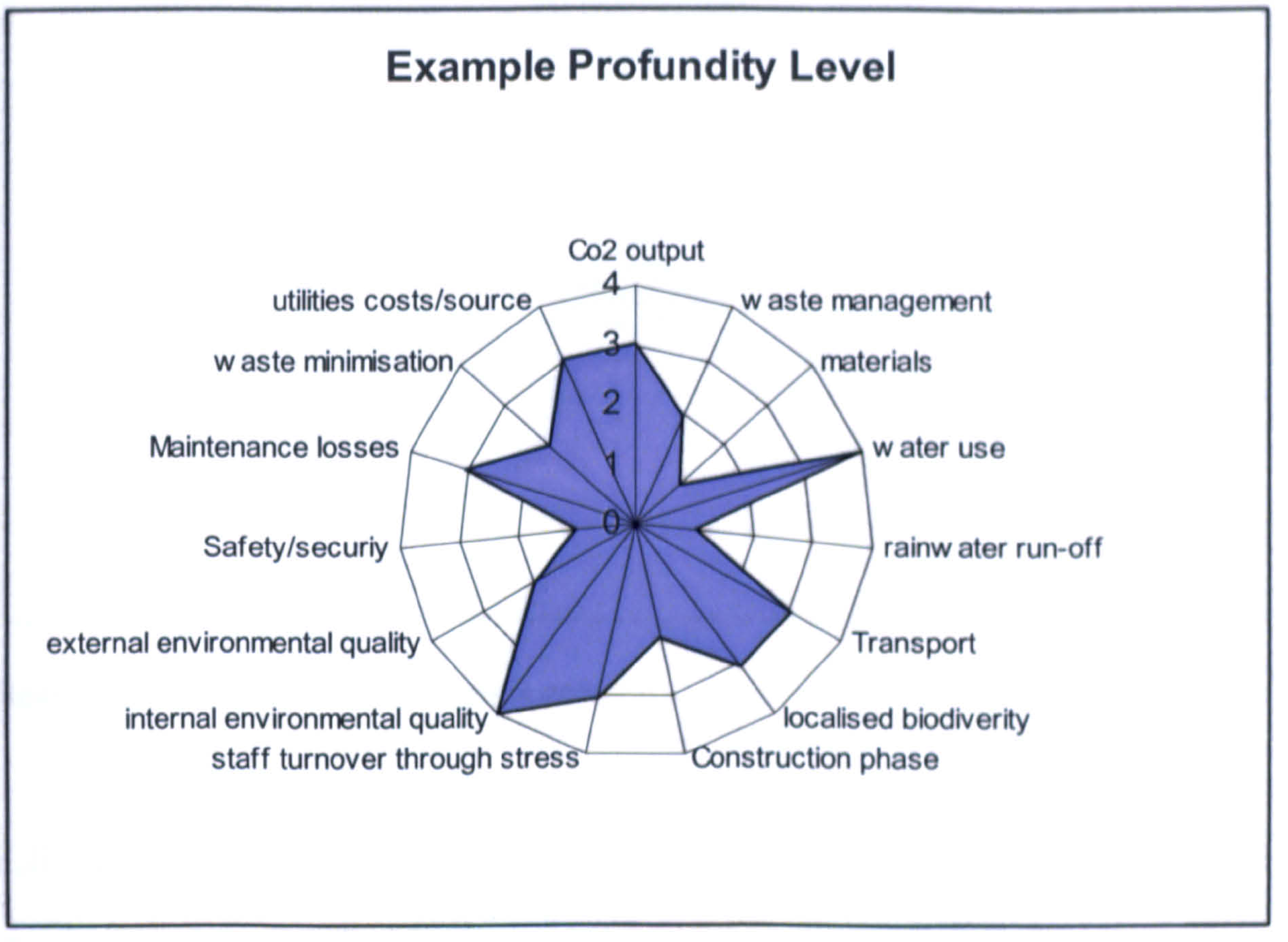


Figure 7-14 An example of a graphic representation

As an example, it is possible to demonstrate the level of profundity in a customized spider graph. This form of visual representation is popular for comparing between projects and re-evaluations at project stages. It does however depend on standardized axis labels to be of any meaning in comparison. As the framework allows these axes to be project specific, it could only be useful in balancing the sum of the profundity rating divided by the number of entered issues for the three philosophical areas of economic, environmental and social considerations. This would be a valuable way of demonstrating that these areas are being balanced. The example below highlights a tendency towards the economic. It could also demonstrate how a project has varied from initial design to completion as profundity of particular actions has been affected by planning conditions or value engineering for example.

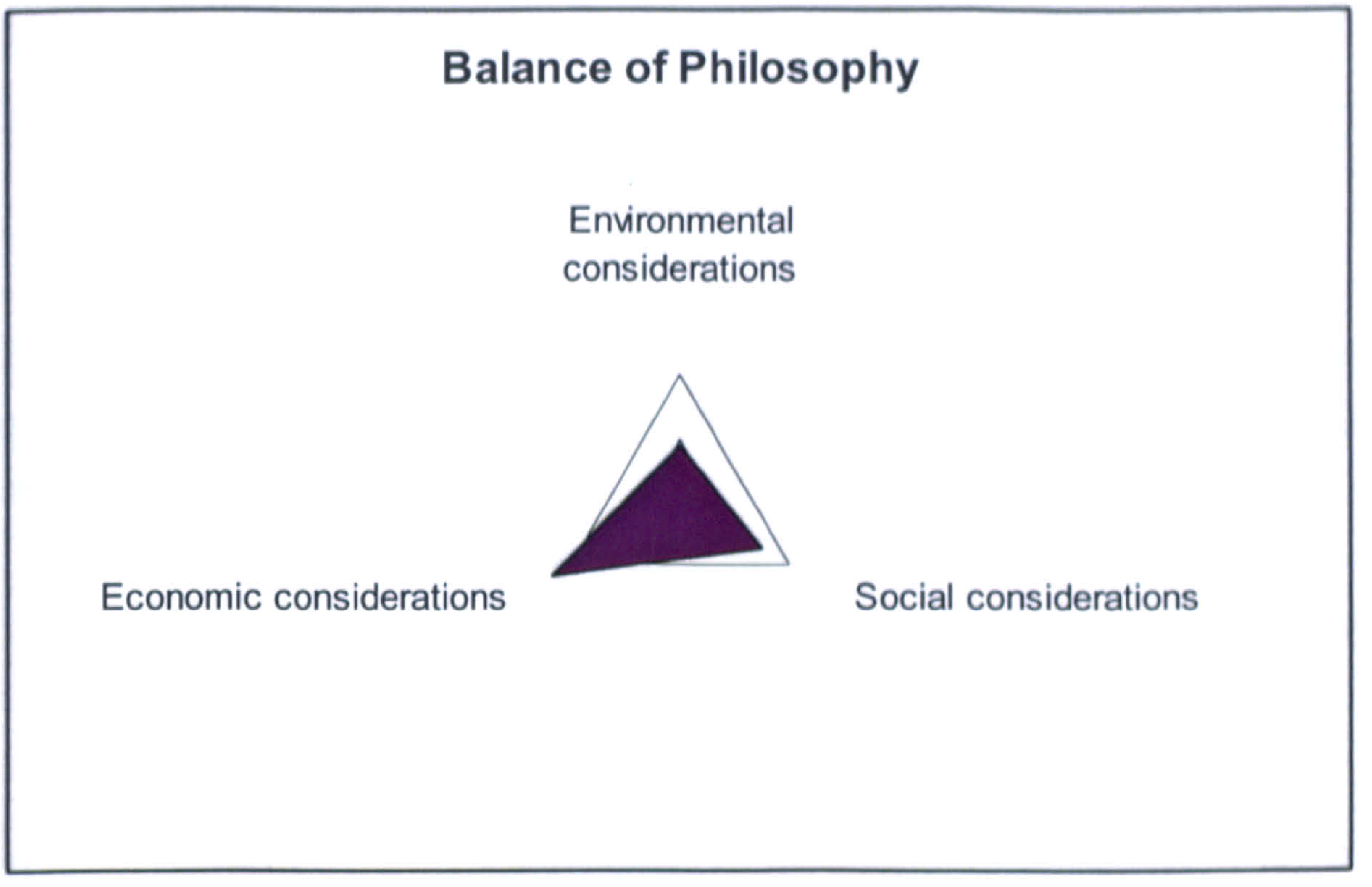


Figure 7-15 An example of graphic representation

7.6 Conclusion

This aim of this chapter was to demonstrate the use of the proposed framework in live projects and response to the SRM matrix in industry and academic fields. This has been demonstrated by a description of the process of implementation of the SRM matrix. Two examples of implementation of the SRM Matrix on retail projects could not sufficiently demonstrate how the process aids the development of sustainability in retail architecture. A *summative evaluation* time series analysis simulation has demonstrated that whilst the working proposal is still a prototype, there is likely to be a positive benefit from implementation in allowing a full exploration of the opportunities in a design brief to improve sustainability and a management document for long term implementation of the client's chosen strategy. Further content and process evaluation has been provided by the survey evaluation of the SRM Matrix as a working design methodology framework proposal. This has in turn informed potential further development of the SRM Matrix. The final chapter will conclude on the research.

8 Conclusion

This chapter concludes on how the thesis has answered the research questions and met the aims and objectives given at the outset. This will be carried out through the following objectives;

1. To restate the research questions, aims and objectives of the research.
2. To summarize how these aims and objectives have been met in the research design.
3. To conclude on the key findings and significance of the research as a whole.
4. To outline recommendations and further research.

8.1 Aims and Objectives

This section seeks to meet the first objective of this chapter by restating the aims and objectives for the research. Industry need for a framework for sustainability was the main rationale for this research which was drawn out of practice experience in the area of retail architecture, and dissatisfaction with the limited response that was being made to address the environmental imperative of sustainability at the time. Challenging these situation led to the proposal that a practical and adoptable method to address and evaluate environmental performance alongside economic performance could help to resolve the paradox of sustainability in the capitalist and consumerist retail environment.

8.1.1 Problem Statement

The problems were stated in Chapter 1 as follows;

1. The impact of design and construction on the environment must be addressed by all construction professionals and not limited to specialist fields and this requires a clear definition of what constitutes sustainability.
2. Retailers have been belatedly responsive to environmental issues and will increasingly be required by their direct stakeholders to recover this delay. What

constitutes sustainable retail architecture must be defined to enable this move to be effective.

3. Existing environmental evaluation methods and tools are under-utilised and evaluation that is carried out may be inconsistent or misleading. Clear methodology must be established to enable the process.
4. Existing communication, technological and financial barriers to sustainability must be broken down and the process of managing sustainability through the stages of design, procurement, operation and maintenance to ensure the consistency of claims must be formulated.
5. The process of change in retailers' opinions and motives must be understood and utilised to ensure that sustainability is the result rather than supposition or deception caused by unrealistic or unfounded claims.

8.1.2 Research Questions

Five main research questions were generated from the problem statement;

a) What is sustainability?
b) What is sustainable architecture?
c) What is sustainable retail architecture?
d) How can sustainable retail architecture be demonstrated?
e) Can a design methodology framework meet this need for retail architecture?

These questions formed the basis for the development of the aims and objectives. The aim of this research was therefore to demonstrate that the provision of sustainable retail architecture is enabled by the development of a design methodology framework that will support improved sustainability for the retail industry. The framework was to take into account existing approaches of environmental evaluation methodologies and utilise the most relevant methods and answer the stated research questions.

8.1.3 Research Design

The research design required to meet this aim required a mixed system of enquiry that took an initially inductive and naturalistic approach or meta learning (Coghlan and Brannick, 2001) to understand the context of the subject and to form a body of knowledge to establish a framework for sustainability in retail architecture. This was followed by an Emancipatory system of enquiry which employed elements from deductive epistemology and change focused iterative forms or Experiential Learning (Coghlan and Brannick, 2001) more commonly found in action research to develop and test a design methodology framework. This mixed system did not follow a traditional route but was devised to suit the cross disciplinary nature of the context and to allow research from with an organisation

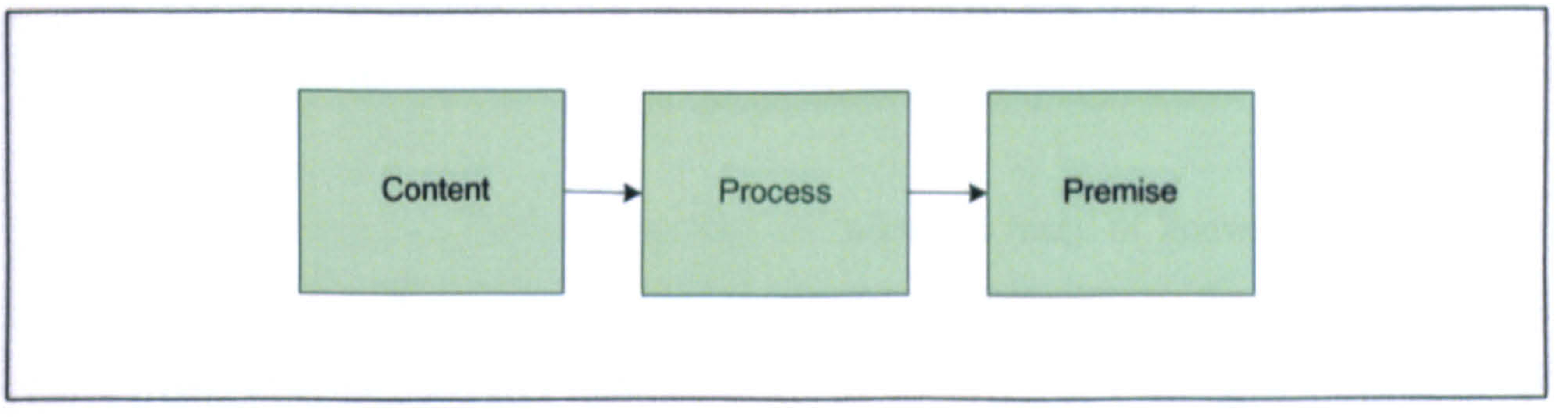


Figure 8-1 Meta Learning

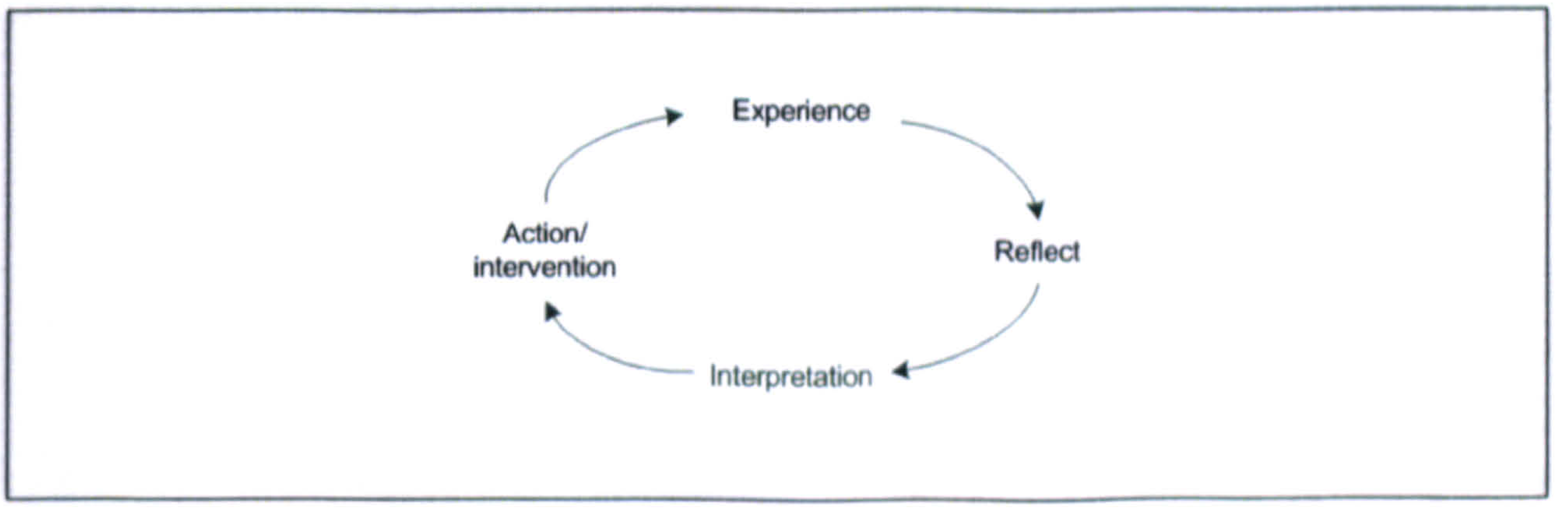


Figure 8-2 Experiential Learning

The objectives were drawn from the aim to answer the research questions in a sequential transformative strategy.

Firstly it was necessary to understand the theoretical development of environmentalism and sustainability in architecture and construction and clearly illustrate the defining principles of sustainability in architecture. These objectives were addressed by a literature review in chapter 2. The next area of context was addressed by seeking to understand the theoretical background of retailing, the performance indicators specific to the retail industry and define the performance indicators of sustainable retail architecture. This was met through literature review and field experience in chapter 3.The third area of context was pursued through a review of the potential use of existing environmental evaluation methodologies and how they can be applied to the particular situation of retail fit-out projects using literature review and simulation strategy in chapter 4. Having established the context it was necessary to understand the specific problems experienced in retail construction relating to the application of environmental principles and demonstrate current practice in the design and construction of retail facilities. Chapter 5 used non-interactive interpretation and correlation strategies to address this objective.

The findings of these objectives together provided the body of knowledge required to create a set of design criteria for a theoretical design methodology framework using the accumulated criteria and knowledge specifically for the retail industry which was tested using iterative/change strategies in chapter 6. Testing the working proposal design methodology framework used simulated and live case study project data and evaluation strategy and tactics in Chapter 7 to demonstrate that the design criteria were met.

8.2 Research Outcome

This section summarizes the research outcomes of each of the observation and reflection chapters, the conceptualisation of the design methodology framework and the pragmatic implementation and validation chapters.

8.2.1 Architecture and sustainability

The concept of sustainability and what that means in sustainable architecture both generally and in the specific case of retail architecture has been described thus;

Philosophy – the balance between the ideologies of environmentalism being used to reduce the social environmental and economic impact of a built form.

1. Ecocentric; meeting the needs of sustainability through ecology
2. Deterministic; meeting the needs of sustainability through anthropology
3. Technocentric; meeting the needs of sustainability through technology

Futurity – the limits of substantiation of the impact of a built form in the future.

1. Intra-generational Sustainability is the meeting of the most basic human needs for immediate survival, air, water, food, shelter and energy.
2. Trans-generational Sustainability allows for the provision of future descendants, employment, trade and economic accumulation as well as health and healthy reproduction provided by clean surroundings and sufficient quantity of food.
3. Inter-generational Sustainability provides for others beyond the family and immediate community. Culture and entertainment, landscape amenity value and food quality, social care and support.
4. Extra-generational Sustainability is provision beyond human survival, concerning the bio-sphere.

Profundity – the level of effort made to reduce impact above the baseline condition.

1. Passive; meeting legislative requirements
2. Active; exceeding legislative requirements or good practice standards
3. Proactive; exceeding legislative requirements through research analysis and development or exemplary practice
4. Industry Leadership; highest possible standards best practice or best practice

These criteria allow the sustainability of specific ideas or measures to be framed in terms of significance or consequence.

8.2.2 The Retail Industry

Economic sustainability has been found to be of paramount importance to the retail industry whilst its' structure and pattern has traditionally provided a barrier to the needs of environmental and social sustainability. This situation has been partially rectified by a period of growth in the development of Corporate Social Responsibility policy and reporting and we must assume that a new era of Corporate Environmental Responsibility in the retail industry has now commenced and this research will be fundamental in helping retailers to meet their new found responsibilities in the retail architecture that is developed in this period.

The opportunities that can be found for reducing environmental and social impact in retail architecture are wide and require a dedicated and comprehensive approach by the whole design team, but architectural practitioners and other construction professionals have a duty to initiate and sustain the discussion with retail procurers.

8.2.3 Environmental Assessment

Environmental assessment methods cannot singly meet the criteria for sustainability set out in chapter 2, but they each have a vital role to play in establishing a detailed picture of the overall impact of a project. Their outputs can be used as independent and comparative performance indicators, but there is no substitute for the experience and skills, lateral thinking and discursive abilities of a design team to rationalise a design proposal together with the building procurer to provide the best outcome that can be achieved. This conclusion was supported by more recent research published by Lutzkendorf, and Lorenz (2006) who also recommend and integrated multiple indicator approach. Validation of intuitive discursive analysis as a valuable decision making tool provides a contribution to knowledge.

8.2.4 Current Practices in retail architecture

A number of barriers to successful implementation of sustainable retail architecture were identified through a series of investigations to obtain information that it not available in published research or other literature. This data was made available partly through the researcher's position within an organisation with specialist experience in retail architecture. Communications within the design and procurement team and the retailer's organisation have a large part to play in ensuring a good outcome. Whilst defining performance indicators specific to sustainability in retail architecture could be helpful, these are not widely applicable and the briefing process needed to be developed to ensure that the retailers CSR policy aims and targets were met alongside legislative standards.

8.2.5 Design Methodology Framework Development

A design methodology framework (IDEAS) was developed using an existing process taken from risk management methodology and modified for this purpose. It provides a discursive framework that allows the design team to utilise their knowledge to provide mitigating strategies to identified sustainability risks in ranked levels of effort (*profundity*) for discussion with the building procurer. The selected strategy is calibrated with appropriate target measures; period of effect (*futurity*) and required action for strategic success (*philosophy)* to ensure that the chosen strategy meets the stated corporate responsibility policy. This design methodology framework was tested on project case studies through its use in a collaborative iterative strategy to ensure that it supported and could be implemented in the design and procurement process and found to be both applicable to the retail sector and transferable to other sectors, demonstrating a contribution to knowledge in successful methodology for managing sustainability in commercial architecture and development. The resulting framework used intuitive discursive analysis principles to derive a sustainability brief through identifying risks to environmental, social and economic sustainability. These risks are addressed by the selection of a mitigation strategy that is supported by a management plan endorsed by the building procurer and passed on to the end-user.

8.2.6 Implementation and Evaluation

The refined working proposal design framework methodology (SRM Matrix) was evaluated through a simulated time series analysis and a peer review by design and construction practitioners. This demonstrated that the working proposal had potential to meet the aims of the research where the building procurer had expressed an interest. Two live ongoing projects are also demonstrated to show how the SRM Matrix is used in a retail setting.

8.3 Limitations

The scope of this research included retail property such as small shops, large department stores and supermarkets, retail developments that may also include other secondary uses (i.e. mixed use with housing or entertainment components) and larger retail distribution and storage facilities. More attention was been paid to facilities that serve the interface between the retailer and their customers and other stakeholders within the wider context of UK towns and cities. Other building uses were outside the scope of the research, but due to the availability of retail projects were required as project case studies in the iterative development process of experiential learning.

The retail practice surveys in chapter 3 were carried out in 2003-4 and might already be somewhat unrepresentative of current working practices. The corporate social responsibility policy review also in chapter 3 was carried out predominantly 2006 and policy and reporting published on-line will be replaced with new reporting information for subsequent years. The research is based on the findings of these very situated investigations and these could not be replicated in the fast changing circumstances of the economics of the retail industry and retail construction projects, the legislative background and the era of transformational declaration by retail business.

Industry collaboration has allowed real data from ongoing projects to be utilized to test methods of analysis and a level of active research on actual projects to form case studies. However this is limited by the case study data being drawn from one architectural practice. The availability of real projects as case studies has been limited by the workload of the supporting practice and the timing of ongoing projects and roll-out programmes.

The level of procurement team co-operation and willingness to modify the design of the project in light of model results could not be controlled for the purposes of the research. Whilst this represents very realistic situations, it does not allow the full spectrum of sustainability possibilities to be explored.

It was not intended that the research would produce a fully functioning model rather that it will provide the basis for the collation of further data and refinement through a greater application in the industry. A working design methodology framework has been developed which is sufficiently refined to be implemented, there is limited evidence that it can be successful in ensuring sustainability risk is well managed through its application.

8.4 Key Findings

The key findings of this research are drawn from the answering of the research questions;

What is sustainability? Sustainability is not representative of a state, but is process, and as such, any given project can be more or less sustainable, some more so than others. This process is not met by just answering a checklist, because this is reactive rather than proactive. There must be a willingness to do more, be better, or accept a greater level of responsibility. If the boundaries are not continually pushed, the result will be a vicious rather than a virtuous circle.

What is sustainable architecture? Sustainability should be evident in all architecture to a less or greater degree, there is no benchmark at which it can be defined but the gradual advancement of legislation is set to ensure that the lowest standard is improved.

What is sustainable retail architecture? To be sustainable, retail architecture must respond to social economic and environmental needs in a proportionate relationship and must meet or exceed requirements set out in legislation. The retail industry is undergoing a process of environmental responsibility revolution. This is an exciting time for the design and construction of retail architecture. This research should provide a platform for this revolution.

How can sustainable retail architecture be demonstrated? It is critical to the reporting of environmental performance of buildings that standardised measurements become established for use in Corporate Responsibility reporting to ensure that comparisons can be made and targets established.

Can a design methodology framework meet this need for retail architecture? Unless definitive statements and targets are established, it is difficult for the procurement team to gauge both the level of commitment to sustainability and also to develop suitable solutions. It is necessary for consultants to be prepared to think laterally and unconventionally in linking issues and creating positive feedback loops to support the financial costs of more sustainable solutions. In many ways this process can be likened to the experiential learning process itself, with professionals undergoing a period of reflection about the issues of sustainability to develop an understanding, this is followed by a conceptualisation of their own understanding towards a strategy to tackle the specific values ethics and design needs of a client organisation. This concept is developed into a design response and ultimately a completed building which is then analysed again in the monitoring and feedback process as the building is occupied. Atherton (2005) has likened this experiential learning and change cycle found in Kolb's model to the dichotomy between art and science where activists feel or experience, and reflectors observe, representing the qualitative and the creative professions. The on the other hand conceptualisers represent the pursuit of theory in pure science and quantitative professions of applied science. Whilst Kolb (1984) argues that this divides the professions into antithesis by the nature of their training an personality , Grant et al (1993) suggest that this is a positivist and therefore outdated viewpoint. Design methodology for sustainability should use all of these positions of antithesis to create a well balance holistic process of synthesis with a team approach. Whilst this is a complex diagrammatic model (Figure 8-3), it is hoped that the design methodology framework facilitates the process in a method that captures the spirit of synthesis.

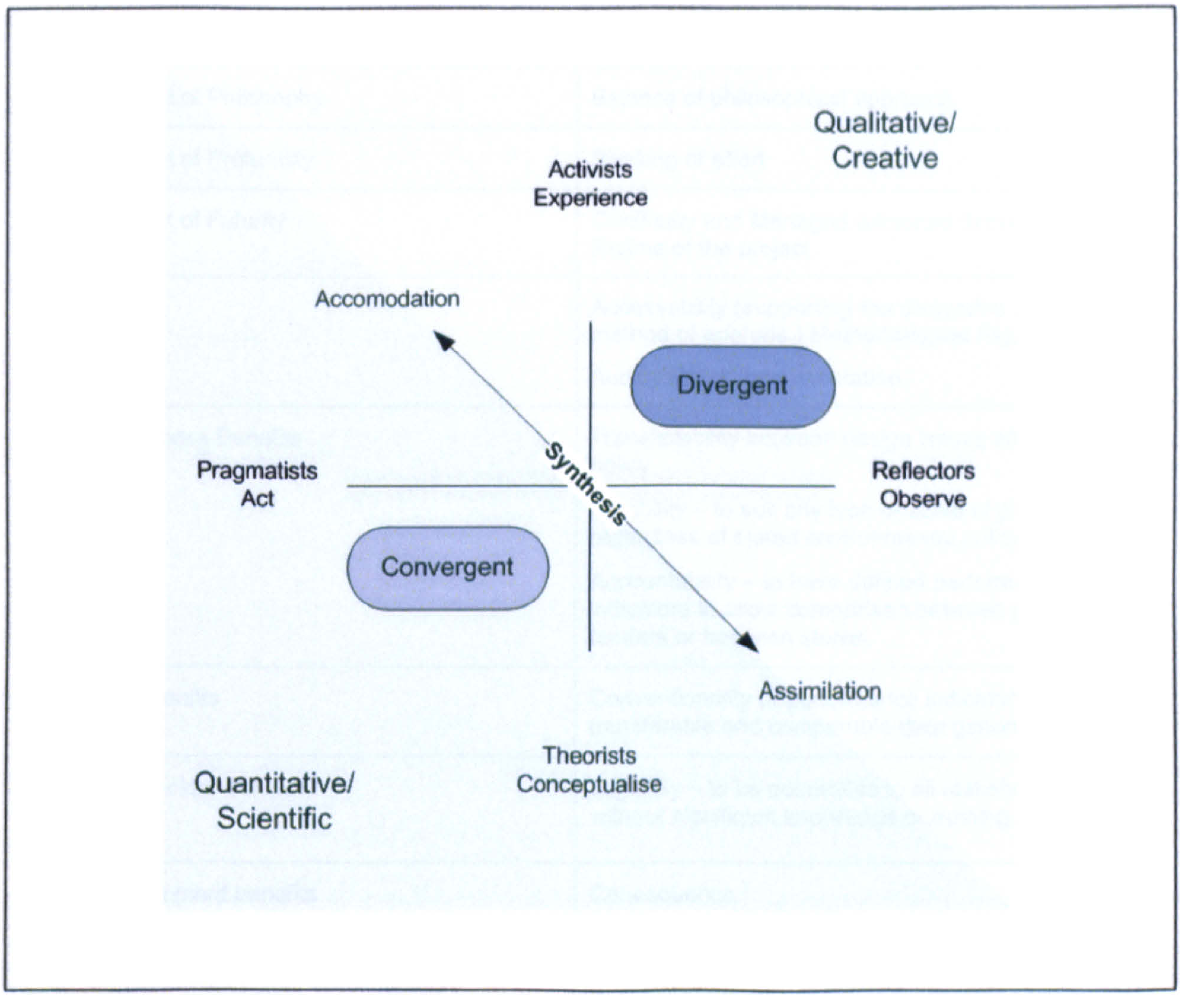


Figure 8-3 Synthesis of the experiential learning model

This process of change has some issues of it's own for the design and construction professions; It is necessary that they consider and plan for the additional time spent on research against conventional design strategies and how this might impact on fees. A level of inertia can be observed but the industry will be led into change and the consultants who embrace these changes have an improved guarantee of future workload. If the contractor is committed to providing a low impact construction to support their own sustainability policy, the process is further facilitated. Well informed Facilities Management is necessary to ensure that the design aims are followed through in the running of the building and that performance criteria are monitored and evaluated in the long term to ensure that the risks identified at the outset continue to be mitigated.

Key design criteria	
Measurement of Philosophy	Balance of philosophical approach
Measurement of Profundity	Ranking of effort
Measurement of Futurity	Continuity and Managed response throughout lifetime of the project
Utilisation	Accessability (supporting the discursive intuitive method of analysis) Methodological Rigour Auditability of documentation
Retailer/business Benefits	Transferability between design issues and CSR policy Flexibility – to suit any type or scale of project regardless of stated environmental policy Accountability – to have defined performance indicators to allow comparison between proposals, tenders or between stores.
Customer benefits	Conventionality of performance indicators and transferable and comparable data generation
Other Stakeholder benefits	Legibility – to be accessible to all stakeholders without significant knowledge or training required.
Wider Environment benefits	Consequence Equivalence to planning conditions (Noise Impact, Archaeology etc).

Figure 8-4Key design criteria for developing the design methodology framework

Comparing the framework to other methods demonstrates that it is most applicable to the specific problem of introducing more sustainable practices to retail design and construction. Other methods address specific issues such as carbon emissions or form checklists and ratings for comparison such as BREEAM and the anticipated Code for Sustainable Buildings. This will only be proved by demonstration of inclusion of the framework into more retail *Client Requirements* (content) or its increased incorporation in design team activities (process). The ideal case subject would be a series of roll-out projects for the same retailer where it might be possible to demonstrate learning and improvement. Accumulation of data of comparable case studies would allow correlation to be carried out; however this was problematic in the research programme due to constraints of case study availability.

8.4.1 Significance

The significance of this research is demonstrated by two major contributions to knowledge;

1. Framework for sustainability provided by the new definitions for the understanding of sustainability developed in chapter 2 which are significant generally in the field of sustainability and sustainable design. Taking these principles to apply to design generally rather than differentiating between aesthetic and technical definition of sustainable design and architecture and responsibility as a concept that counters risk.

2. The development of the design methodology framework, which uses the conceptual framework for sustainability to apply to the intuitive discursive analysis used in design decision -making. This research has offered an approach to aid in strategy clarification and whilst allowing the predominant issues and metrics to be determined as each project requires in the setting and time frame that is appropriate to the programme of each project. Research by Turner (2006) supports the need for a decision support system or package that is comprehensive and coherent. Kaatz et al (2006) also recommend integration, transparency and accessibility and collaborative learning as key to the effectiveness of a building sustainability assessment method. The SRM matrix approach meets these requirements. The risk-based approach is also supported by more recent publication by the Carbon Trust (2006), which recommends the principle of identifying and measuring the largest problems (risks) before implementing

mitigating strategies. John Lewis (John Lewis Partnership, 2007) have also developed a framework for their internal use which breaks down the project into work stages with responsibilities and metrics, but does not strategise the actions. A forthcoming publication by Horlick Jones and Begg (2007) may also follow similar principles.

8.5 Recommendations

8.5.1 Further improvements to the SRM Matrix

Availability of the tool as a web based interactive format would be advantageous as part of the procedural process for design projects. This development is beyond the scope of this research, however could be managed through existing project management portal information systems used widely in the construction industry

External availability of the SRM Matrix is a fully legible methodology that is managed as a matrix but is equally manageable as a paper format and does not contain concealed calculations and as such it is easily replicable. It is not the intention of this research to limit access to the framework for business aims. It is rather the hope of the researcher that through publication, sustainable approaches to retail design will be facilitated on a much wider scale, and making a considerable reduction in the environmental and social impact of retail facilities generally without compromising the economic sustainability of the UK retail industry on which not only a large part of UK architectural workload depends, but also provide is a major employer and critical to the national economy generally.

8.5.2 Further research

Comparing the framework to other methods would demonstrate if it is more applicable to the specific problem of introducing more sustainable practices to retail design and construction. This could only be proved by demonstration of inclusion of the framework into more retailers' *Client Requirements* (content) or its increased incorporation in design team activities (process). This would represent a move from a reflective study of professional practice to a large scale transformational change as an implementation research process within an organisation (Figure 8-5). Accumulation of data of comparable case studies would allow correlation to be carried out. The ideal case subject would be a series of roll-out projects for the same client over a period of time where it might be possible to demonstrate learning and improvement and recommended as a subject for further research.

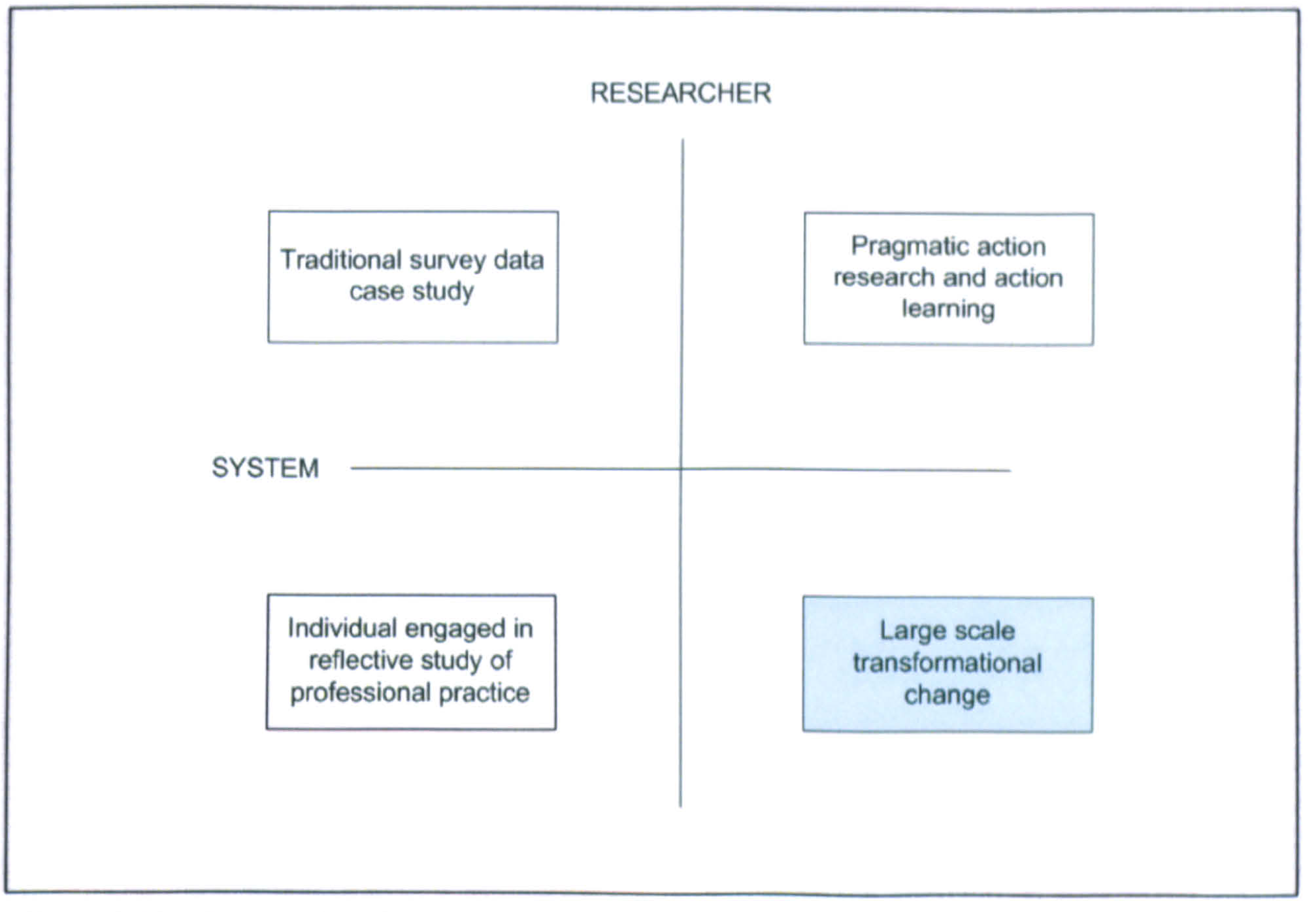


Figure 8-5 Implementation (Coghlan and Brannick, 2001)

8.6 Concluding remarks

Therefore in conclusion, sustainable retail architecture is both possible and achievable. It must always seek to move towards genuine industry leadership that is not just shrewd brand leadership through green marketing. This process is entirely dependent on the commitment of all stakeholders to be responsible and ethical. This research has allowed the development of a framework methodology to approach the sustainable design of not only retail projects but a wider spectrum of commercial work. The outcome of the research should provide a platform for the construction industry to perform quantitative and qualitative analyses for retail clients having fully established all the related issues and effects. The working design methodology framework proposal (SRM Matrix) will allow clients to embody their CR policy into the public interface of retail architecture and allow retailing as a form of entertainment to be more sustainable and socially acceptable. This process would appear to stem from an executive edict in each case and is used as a promotional and brand positioning tool leading to perceived good publicity in UK press. This process will only be supported by effective management of sustainability in new projects and throughout the existing portfolio of retail architecture.

List of References

ABIDIN, Nazirah. Zainul., PASQUIRE, Christine. L., 2005. Delivering Sustainability through Value Management: Concept and Performance Overview. *Journal of Engineering, Construction and Architectural Management.* 12 (2) 168-180.

ADETUNJI, Israel., 2006. Sustainable Construction; A web based performance Assessment Tool. PhD Thesis, CICE, Loughborough University: UK.

AGGREGAIN., 2006. <www.aggregain.org.uk> [accessed 12 December 2006]

ALEXANDER, Keith., 1996. *Facilities Management; Theory and Practice.* London: Taylor and Francis.

ALEXANDER, Keith., 2004. *Facilities Management; Innovation and Performance.* London: Taylor and Francis.

ANDERSON, Evan E. 1979 An Analysis of Retail Display Space: Theory and Methods *The Journal of Business*, Vol. 52, No. 1 (Jan.), pp. 103-118.

ANDERSON, Jane., SHEIRS, David. E., 2002 (3rd Edition). *The Green Guide to Specification.* Oxford: Blackwell.

ASHWORTH, Allan., 1994. *Cost Studies of Buildings.* Harlow: Longman.

ATHERTON, J S., 2005. *Learning and Teaching: Experiential Learning.* UK: Available: <http://www.learningandteaching.info/learning/experience.htm>_ [Accessed: 19 April 2007]

BAIN, Anthea., 2003. Green Gauge. *Intra*, February, 25.

BAMFORTH, Phil., 2003 *Issues in design for whole life performance and cost.* Technical paper 10-11 April. Taylor Woodrow, Engineering & Consultancy Division, University of Bath.

BANHAM, Reyner., 1984. *The Architecture of the Well-Tempered Environment.* London: The Architectural Press.

BARDE, Jean-Philippe., PEARCE David W. Ed., 1991. *Valuing the Environment: Six Case Studies.* London: Earthscan Publications Ltd.

BARNITT, Harry., 2002. The Light Choice. *Red*, June,. 22-32.

BARRET, Richard., 1998. *Liberating the Corporate Soul: Building a Visionary Organisation.* Boston: Butterworth-Heinemann.

BARRETT, Richard., 2005. *Origins of the Seven Levels of Consciousness Model.* <www.valuecenter.com> [accessed 2 July 2006].

BARRY, Mike,. 2003. *Drawing Together Sustainable Production and Consumption at Marks and Spencer* UNEP Industry and Environment January-March 2003 p13-15.

BARNTHOUSE, L., W., 1993, *Ecological Risk Assessment.* USA: CRC Press.

BAYLEY, Stephen., 2005.What Happened to Vittorio Radice? *Intra,* March, 8.

BDP Planning Oxford Institute of Retail Management., 1992. *The Effects of Major Out of Town Retail Development.* London: HMSO

BEADLES, J., 2003. Waste Management. Institute of Waste Management. Jan p29-30.

BELL, Malcolm., 2004. *Energy Efficiency in Existing Buildings: The role of building regulations.* <www.rics.org> [accessed 12 Sept 2006] (Procedings of the COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 84.

BELL, Simon., MORSE Stephen., 1999. *Sustainability Indicators: Measuring the Immeasurable,* London: Earthscan Publications Ltd.

BHASKARAN, Lakshmi., 2005. More than skin deep. *FX* Februaury, 44-46.

BIBBY, Lee., 2003. Improving Design Management Techniques in Construction. PhD Thesis. CICE, Loughborough University: UK.

BIRCH, Amanda., 2003. East Of Eden. *Building Design* , May 2, pp11.

BORDASS, William., 2001. *Flying Blind.* Oxford: EEASOX.

BORSI, Franco., 1997. *Architecture and Utopia.* Paris: Editions Hazan.

BRE 2006 <www.bre.co.uk/pdf/envest_results/pdf 26/0603> [accessed 16 March 2006]

BRE, 2007(a), *The Red Book; A Specifies Guide (The Red Book Live)* < http://www.redbooklive.com> [Accessed April 25 2007]

BRE 2007(b) National Calculation Method <http://www.ncm.bre.co.uk/index.jsp> [accessed 23 April 2007]

BRE, 2007(c). *Smart Waste.* <http://www.smartwaste.co.uk/>[Accessed 25 April 2007]

BREEAM., 2006. <www.breeam.org.uk> [Accessed 12 December 2006]

BRESCU., 2000. Good Practice Guide 287: *The team's guide to Environmentally smart buildings – energy efficient options for new and refurbished offices.* London: BRE Publications.

BRESCU., 2000. Good Practice Guide 303. *The designers guide to energy- efficient buildings for industry.* London: BRE Publications.

BRESCU., 2000. Good Practice Guide 304. *The purchaser's guide to energy-efficient buildings for industry*. London: BRE Publications.
BRESCU., 2000 Good Practice Guide 388. *Energy-efficient design of new industrial buildings*. London: BRE Publications.
BRINGEZU, Stefan,. 2002. Construction Ecology and Metabolism in KIBERT, Charles J., SENDZMIR, Jan., GUY, G. Bradley., Ed 2002. *Construction Ecology: Nature as the basis for green buildings*. New York: Spon Press.
BRITISH LAND., 2005. <www.britishland.com> [accessed 23 September 2005].
BROWN, Andrew. W., PITT, M.R., 2001, Measuring the facilities Management Influence in Delivering Sustainable Airport Development and Expansion. *Journal of Facilities Management*. 19(5/6) 222-232.
BROWNHILL, Deborah., SUSHEEL, Rao., 2002. *A Sustainability checklist for developments: A common framework for developer and local authorities*. London: BRE.
BUILDING MARKET TRANSFORMATION, 2006. Retail Workshop. 26 October 2006<www.eci.ox.ac.uk/research/energy/downloads/bmt-retailworkshop.pdf> [accessed 16 March 2007.
BUTLER, Sarah., 2005. Organic grocer replaces Barkers. *The Times (Business)*, August, 20, pp53.
BUTLER, Trevor., 2006. Beyond the regulations. *Building Design* , June 16, pp21.
CABE, 2004. Design Reviewed: town centre retail. London: Cabe.
CALOW, Peter., 1998, *Handbook of Environmental Risk Assessment and Management*. London: Blackwell.
CAPITAL SHOPPING CENTRES. Metro Centre, <www.capital-shopping.co.uk> [accessed 10 July 2006]
CARBON TRUST, 2006. Carbon Footprints in the Supply Chain; The next step for business. November. CT616.
CATO Molly Scott, KENNETT Miriam. Ed., 1999. *Green Economics Beyond Supply and Demand to meeting people's Needs*. Aberystwyth: Green Audit Books.
CANT, Michael., 2005, *Collaboration in Infrastructure Services in Regional Retail Centres. Value-added Contribution of Facilities Management in the Birmingham Bullring*. Journal of Facilities Management, 3(3) 215-225.
CARTER Elliot., 2007, *Making Money from Sustainable Homes: A Developers Guide*. London: CIOB & PDM Consultants.

CBI., 2002. Making Energy Work. *Business Guide*. February. London: Caspian publishing
CHAPPELL David., 1992 (7th Edition). *The Architect in Practice*. Oxford: Blackwell Scientific.
CHAPPELL David., 2000 (6th Edition). *Understanding JCT Standard Building Contracts*. London: Spon.
CHAPPELL David., 2002 (5th Edition). *Legal and Contractual Procedures for Architects*. Oxford: Architectural.
CHISHOLM, Jamie. 2006. Retail sales fall as World Cup effect wanes. *Financial Times*. 17August
COGHLAN, David,. BRANNICK, Teresa., 2001. Doing Action Research in Your Own Organisation. London: Sage.
COM 2002/91/EC: Directive on the Energy Performance of Buildings.
COMMONER, Barry., 1992. *Making Peace with the Planet*. 5th Ed. New York: The New Press.
CONSIDERATE CONSTRUCTORS SCHEME,. 2006. <www.considerateconstructorsscheme.org.uk> [Accessed 12 December 2006].
CONSTRUCTING EXCELLENCE., 2006. Measuring Excellence. *IT Construction Forum*. Issue 2, Spring 9
CONSTRUCTION CLIENTS' FORUM,. 1999. *Whole Life Costing; A clients Guide*. London; CCF.
CRESWELL, John. W., 2003. (2nd Edition). Research Design; Qualitative, Quantative and Mixed Methods Approaches. London: Sage.
CUFF, Diana., 1991, Architecture: Story of Practice. MIT Press.
DALE, Gillian., 1989. *The Business of Retailing*. London: Hutchinson.
DALLAS, Michael. F., 2006, *Value and Risk Management: A Guide to Best Practice*. London: Blackwell.
DAVIS LANGDON., 2005, The Architects workload survey <www.mirza-nacey.com> [accessed 22 November 2006] Building 05 August, pp45-59.
Disability Discrimination Act 1995 (c. 50)
DEFRA, 2006. *Recycling and Waste*. <www.defra.gov.uk>. [Accessed 12 September 2006]

DEFRA 2006. *Environmental Protection.* <www.defra.gov.uk> [Accessed 12 September 2006]

DEFRA 2006. EU Directive on the Energy Performance of Buildings. <www.defra.gov.uk> [Accessed 12 September 2006]

DING, Grace. K. C., 2005. Developing a multi-criteria approach for the measurement of sustainable performance. Building Research and Information. Volume 33, Number 1 January-February. P3-16.

DING, Grace. K. C., 2004. *The development of a multi-criteria approach for the measurement of sustainable performance for built projects and facilities* PhD Thesis Sydney University of Technology: Australia.

DIRECTIVE 2002/91/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL *The energy performance of buildings*, Official Journal of the European Communities. 16 December 2002.

DIXON, Tim., 2003. *The role of UK retailing in urban regeneration.* Reading England: College of Estate Management.

DIXON, Tim., MARSTON, Andrew., 2002 UK Real Estate and the Effects of On-Line Shopping. *Journal of Urban Technology.* December. Pp19-47.

DOW JONES., 2006. <www.sustainable-index.com> [accessed 05 September 2006]

DOBSON, Andrew., ed., 1991. *The Green Reader.* London: Deutsch.

DTI, 2006. 6385 Our Energy Challenge January 2006<www.dti.gov.uk> [accessed 12 November 2006]

DTI., 2000 *Building a Better Quality of Life.* London: DTI

ECKERSLEY, Robyn. Ed. 1995. *Markets, the State and the Environment; Towards Integration.* London: Macmillan Press.

EDWARDS, Brian., 2005. *Rough Guide to Sustainability.* London: RIBA Enterprises Ltd.

EDWARDS, Brian., ed., 1998. *Green Buildings Pay.* London: Spon.

Energy Savings Trust, , 2006. Energy calculator tool <www.est.org.uk> [accessed 15 July 2006].

ENTWISTLE, Jill., 2006. Honourable discharge. *LIGHT,* April, pp9-12,

ENTWISTLE, Jill., 2006.Technology led. *RED,* March, pp21-22.

ENTWISTLE, Jill., 2004. Room for change. *RED,* September, pp41-44.

EP LABEL. 2005. <www.eplabel.org> [accessed 23 September 2005].

FARMER, J., 1996. *Green Shift: Towards a Green Sensibility in Architecture.* Oxford: Butterworth Architecture.
FERRY, Douglas J., BRANDON Peter S., FERRY, Jonathan D. 1999 (Seventh Edition). *Cost Planning of Buildings.* London: Blackwell Science Ltd.
FIELD, J.W., SOPER, J.H.B. 1997. *Understanding the energy performance of commercial and high street buildings.* Paper 29, <http://www.targ.co.uk/index.htm> [accessed 16 March 2007]
FIELDSON, Rosemary,. KAMARA, J.M. 2004, *Towards an Evaluation Framework for Sustainability in Retail Design.* <www.rics.org> [accessed 12 Sept 2006] (Proccdings of COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, p 166)
FIELDSON, R., KAMARA. J.M.2004, T*he value of whole life costing and life cycle analysis in the retail environment.* Refereed Conference Paper SCRI International built & human environment research week. 29 March –4 April 2004.
FIELDSON, R. KAMARA. J.M.2006 *A framework for sustainability in commercial architecture.* in Dulaimi, M. (ed.), *Proceedings of the Joint International Conference on Construction Culture, Innovation and Management (CCIM)*, 26-29 November, Dubai, UAE [Paper 107 in CD-ROM Proceedings]
FIELDSON, R., 2007 *Sustainability Risk Management; An approach that incorporates sustainability into the design, construction and management of buildings.* Construction Information Quarterly. 9 (1) pp 7-12

FLANAGAN Roger, NORMAN George, MEADOWS Justin, ROBINSON Graham, 1989. *Life Cycle Costing; Theory and Practice.* Oxford BSP Professional Books.
FTSE 4 GOOD., 2006 <www.ftse.com> [Accessed 05 September 2006]
FX 2005 Sustainability Issues: It's a jungle out there... April pp 40-42
GANN David M, Salter Ammon, J., Whyte Jennifer K., 2003 Design Quality Indicator as a Tool for Thinking. *Building Research and Information.* Volume 31, Number5/September-October p 318-333
GARROD Guy, WILLIS Kenneth G., 1999, *Economic Valuation of the Environment.* Cheltenham, Edward Elgar Publishing Ltd.
GARROD, Richard., 2002 Taxing Decisions *Red*, Sept, 41-43.
GATES, Charlie., 2002. Sustainability move scorned by RIBA expert. *Building Design*, 26th July, 3.

GENERAL XVII FOR ENERGY AND THE ARCHITECT'S COUNCIL OF EUROPE., 1999. *A Green Vitruvius*. London: James & James.

GETHING, Bill., BORDASS, Bill., 2006. Rapid assessment checklist for sustainable buildings. *Building Research and Information*. Volume 34, Number 4 July/August. p416-426

GILBERT, David., 1999. *Retail Marketing Management*. Harlow: Pearson Education.

GIRALDO, Juan David., NAPOLEON, Franco., 2002. Quantitative and Qualitative Study of Shopper Behaviour in Hypermmarkets, *ESOMAR*, Latin American Conference, Sao Paulo, May, p.439-460

GIVONI, Baruch., 1969. *Man, Climate and Architecture*. 2nd Edition. Essex: Applied Science Publishers.

GIVONI, Baruch., 1998. *Climate Considerations in Buildings and Urban Design*. New York: Van Nostrand Reinhold.

GLASER, Karen., 2006. Sector Retail. *Intra*, April, 17-22.

GOLDSMITH, Edward., 1972. *Blueprint for Survival*. London: The Ecologist.

GRANT Donald Pete., De VRIES, J.M., CROSS, Nigel., 1993, *Design Methodology and relationships with Science*. London: Springer.

GREENSPEC., 2006. <www.greenspec.co.uk> [Accessed 12 December 2006]

GREEN CONSUMER GUIDE , 2006. <www.greenconsumerguide.com> [accessed 18 June 2006].

GRIMLEY., 2005. *Retail Trends Report Second Quarter*. London: GVA Grimley.

GROAT, Linda., WANG, David., 2002. *Architectural Research Methods* New York: John Wiley & sons.

GUPTA R., 2005. Investigating the potential for local carbon emissions reduction: Developing a GIS based domestic energy, carbon counting and carbon reduction model (DECoRuM). Refereed technical paper. Proceedings of the 2005 Solar World Congress. 6-12 August 2005 Orlando Florida, USA.

GUY, S., FARMER, G., 2001. Reinterpreting Sustainable Architecture: The Place of Technology. *Journal of Architectural Education*, February, 140-148.

GUY, S., SHOVE, E., 2000. *A Sociology of Energy, buildings and the environment: Constructing Knowledge, Designing Practice*. London: Routledge Research Global Environmental Change.

HAGAN, Susannah., 2001. *Taking Shape: A new Contract between Architecture and Nature.* Oxford: Architectural Press, Butterworth-Heinemann.
HALLIDAY, Sandy., 2000. *Green Guide to the Architects Job Book.* London: RIBA Publications.
HANLEY Nick., SPASH, Clive., 1993. *Cost Benefit Analysis and the Environment.* Aldershot: Edward Elgar Publications.
HAWKES, Dean., 1996. *The Environmental Tradition.* 1st Ed. London: Spon.
HAWKES, Dean., OWERS Janet., 1981. *Architecture of Energy.* UK: Construction Press.
HESTER, R. E., HARRISON, B.D., HARRISON, R.M., Ed., 1998. *Risk Assessment and Risk Management.* London: Royal Society of Chemistry.
HITCHCOCK, R.J., PIETTE, M. A., SELKOWITZ., S.E. 1998. Documenting Performance Metrics in a Building Life-cycle Information System. Proceedings of Green Building Challenge Conference, 26-28 October Vancouver.
HODGES, Christopher. P., 2005, A Facilities Manager's Approach to Sustainability. *Journal of Facilities Management.* 3(4) 312-324.
HOLM, Ivor., 2006, *Ideas and Beliefs in Architecture and Industrial Design.* PhD Thesis, Oslo School of Architecture.
HORLICK-JONES, Tom., ROSENHEAD, Jonathan., GEORGIOU, Ion., RAVETZ, Jerry., and LÖFSTEDT, Ragnar., (2001) 'Decision support for organisational risk management by problem structuring' *Health, Risk & Society* 3(2) pp.141-165.
HORLICK-JONES, Tom., BEGG, Katie. 2007 (forthcoming) Environmental Decision Making Handbook. London: Elgar.
HUDSON, John. In ALEXANDER, Keith., 2004. *Facilities Management; Innovation and Performance.* London: Taylor and Francis.
HURST, Will., 2006.Treasury: take whole life costs into account, *Building Design* 19 June, 2.
HYDE, Richard., 2000. *Climate Responsive Design.* London: Spon.
IRVING, S.J., 2004, *Sustainable Construction, Climate change and Building Regulations.* <www.rics.org> [accessed 12 Sept 2006] (Procedings of the COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 51-58.

JAUNZENS, D. WARRINER, D. GARNER, U. WATERMAN A. 2001. *Applying facilities expertise in building design*. BRE: London.
JOHN LEWIS PARTNERSHIP, 2007. A Framework for delivering sustainable construction in the retail sector.
<www.johnlewispartnership.co.uk/Download.aspx?ResourceId=10432 >
[accessed 16 March 2007]
JOHNSON, Stuart., 1993. Greener Buildings, Environmental Impact of Property. London: Macmillan.
JONES, K., CLEMENTS-CROOME, D., 2004. *Towards a sustainable urban environment*. <www.rics.org> [accessed 12 Sept 2006] (Proceedings of the COBRA International Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 100.
JONES, P. G., BOND, M., GRIGG, P. F. 1999. *Energy Benchmarks For Retail Buildings* - CIBSE National Conference.
KAMARA, J. M., ANUMBA, C. J. and EVBUOMWAN, N. F. O., 1999. Client requirements processing in construction: a new approach using QFD. *Journal of Architectural Engineering*, 5(1): 8-15.
KAATZ E., ROOT, D.S., BOWEN, P.A., HILL, R., 2006. Advancing Key Outcomes of Sustainability Building Assessment. Building Research & Information. Volume 34, Number 4/ July/August. p308-320.
KIBERT, Charles J., SENDZMIR, Jan., GUY, G. Bradley., Ed 2002. *Construction Ecology: Nature as the basis for green buildings*. New York: Spon Press.
KIRK, Dr Stephen J., DELL'ISOLA Alphonse J., 1995. *Life Cycle Costing for Design Professionals*. New York: McGraw-Hill.
KIRKHAM, R.J., ALISA, M., PIMENTA DI SILVA, A., GRINDLEY, T., BRONDSTED, J., 2004. Eurolifeform: an integrated proabalistic whole life cost and performance model for buildings and civil infrastructure. <www.rics.org> [accessed 12 Sept 2006] (Procedings of the COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 142.
KISHK, M., POLLOCK, R., 2004. *An Extended Whole-Life Costing Framework To Achieve Best Value*. <www.rics.org> [accessed 12 Sept 2006] (Procedings of the COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 88.

KNUTT Elaine, Winning green hearts, *Building Design* May 16 2006 pp19.
KNUTT, Elaine., Renewables Red Herring? *Building Design* January 6 2006 pp15.
KOLB, D., A., 1984. *Experiential Learning: Experience as the source of learning and development.* Englewood Cliffs New Jersey: Prentice Hall.
KUCHAREK, Jan-Carlos, *Emissions Impossible?* RIBA Journal May 2005, 66-68.
LANGSTON, Craig A., DING Grace K.C. 2001, *Sustainable Practices in the Built Environment.* Second Edition, London, Butterworth-Heinemann.
LAVENDER, Stephen D., 1990. *Economics for Builders and Surveyors – Principles and Applications of Economic Decision Making in Developing the Built Environment.* Harlow: Longman Scientific and Technical Press.
LEGGETT, Jeremy., 2002. Power to the People -For the People. *ADC&D*, April, 3.
LEWIN K.,1942, "Field Theory and Learning" in D Cartwright (ed.) *Field Theory in Social Science: selected theoretical papers*, London; Social Science Paperbacks, 1951
LITTLE, Jenny., 2005. A vegan dealing in dead animals. *The Mail on Sunday*, August 21, pp3.
LITTLEFIELD, David., 2002. Ken gets tough on energy cuts. *Building Design*, 12 April, pp4.
LLEWELLYN, J.W., EDWARDS, S., Ed 1998. *Towards a Framework for Environmental Assessment of Building Materials and Components.* London: BRE.
LLOYD JONES, David., 1998. *Architecture and the Environmental: Bioclimatic Building Design.* London: Lawrence King.
LOE, Eric., 2000. *The Value of Architecture: Context and Current Thinking. London*: RIBA Publications.
LOVELOCK, James., 1979. *Gaia: a new look at life on Earth.* Oxford: University Press
LUPTON, Martin., 2006. Lighting Affects. *RED*, January, 25-27
LUTZKENDORF, Thomas., LORENZ, David. P., 2006 Using an integrated performance approach in building assessment tools. Building Research & Information. Volume 34, Number 4 July/August 2006. pp334-356.
LYONS, Teena., 2005. The Walmart of wheatgerm leads an organic invasion. *The Mail on Sunday*, August 21, pp 3.
McFAYDEN, E., 1988. *The changing face of British Retailing.* London: Newman.
MADINE, Victoria., 2005. Shades of Green. *Building Design*, March 24. pp21-23

MALTHUS, Robert T,. (Ed Donald Winch)1992 *Cambridge texts in the history of political thought: Malthus: An Essay on the Principle of Population.* UK; University of Sussex.

MARSHALL Catherine, ROSSMAN Gretchen. 1995 (second Edition). Designing Qualitative Research. California: Sage Publications Ltd.

MAY, Tim., 2001 (3rd Edition). *Social Research; Issues, Methods and Process.* Buckingham: Open University Press.

MAY, Tim., 1998. 'Reflexivity in the Age of Reconstructive Social Science' in *International Journal of Social Research Methodology, Theory and Practice* (Vol 1 No 1, January - March)

MEADOWS, D., 1972. *The Limits to Growth.* New York: MIT.

MCKEEVER Karl,. 2005. What's Next. *Red,* December, 29-32.

MILLER Daniel 1998 *Theory of Shopping* Cambridge: Blackwell/Polity Press

MILLER Vikki Government to propose tax breaks for green buildings. *Building* 25 August 2006.

MIRZA & NACEY RESEARCH., 2007, Buisness; Workloads (Architects Workload Survey). *Architecture Today 176,* March, pp74.

MISTRY, Bhavna., 2002. Profile: Kraka. *Red* June p15-16

MORGAN Peter, 1988. *Retail Development.* London: Estates Gazette.

MOXLEY, Ray., 1993. *Building Management by Professionals.* Oxford: Butterworth Architecture.

NATIONAL ECONOMIC DEVELOPMENT OFFICE, 1971, *The future Pattern of Shopping.* London: Her Majesty's Stationary Office.

NATIONAL GREEN SPECIFICATION., 2005, <www.greenspec.co.uk>[accessed 26 September 2005]

NATIONAL GREEN SPECIFICATION. 2007, <http://www.greenspec.co.uk/html/features/WasteCost.html> [accessed 25 April 2007]

NATIONAL STATISTICS OFFICE. 2006, <www.statistics.gov.uk> [Accessed 18 August 2007].

NIJKAMP P., RIETVELD P., VOOGD H., 1990, *Multicriteria Evaluation in Physical Planning.* New York, Elsevier Science Publishers.

NURDEN, Robert., 2002. Virtual deterioration model dismissed as hype. *Building Design.* 17 May, pp4.

O'BRIEN, H., HARRIS, F., 1991. *Retailing; Shopping, Society, Space.* London: David Fulton Publishers.

OFFICE OF THE DEPUTY PRIME MINISTER., 2006. *Building Regulations Part L (Conservation of Fuel and Power)* London: ODPM.

OFFICE OF THE DEPUTY PRIME MINISTER., 2003. *Guidance for the use of carbon emissions calculation method.* TM32, London: ODPM.

OFFICE OF THE DEPUTY PRIME MINISTER ., 2006. *Approved Document M - Access to and use of buildings,* London: ODPM.

O'LEARY, Zina., 2004. *The Essential Guide to Doing Research.* London: Sage

OLGYAY, Victor., 1963. *Design with Climate: Bioclimatic approach to architectural regionalism.* Princeton New Jersey: Princeton University Press.

OLOMOLAIYE, A., LIYANAGE, C.L., EGBU, C.O., KASHIWAGI, D. 2004 Knowledge Managemant for Imroved performance in Facilities Management. <www.rics.org> [accessed 12 Sept 2006] (Proceedings of the COBRA The international Construction Conference, 7-8 September, Leeds Metropolitan University 2004, pp 105.

OPPENHEIM A.N.,1992 (2nd Edition), Questionnaire Design, Interviewing and attitude measurement. London: Pinter Publishers Ltd.

O'RIORDAN, T., 1981. *Environmentalism.* 2nd Edition. London: Pion.

OSBORN, Derek., BIGG, Tom., 1998 *Earth Summit II: Outcomes and Analysis.* London: Earthscan.

PACEY, Stephen., 2003. No More Guessing Games *RIBA Journal* May p 81-83

PAPANEK, Victor., 1995. *The Green Imperative: Ecology and Ethics in Design and Architecture.* London: Thames and Hudson.

PEARCE David, MARKANDYA Anil, BARBIER Edward B. London Environmental Economics Centre. 1989, *Blueprint for a Green Economy.* London, Earthscan Publications Ltd.

PEPPER, David., 1984. *The Roots of Modern Environmentalism.* Beckenham, Kent: Croom Helm Ltd.

PHILIBERT Cedric., 1999. The Economics of Climate Change and the Theory of Discounting Energy Policy Volume (issue): 27 (15) p913-927.

PONTING, Clive., 1991. *A Green History of the World; The Environment and the Collapse of Great Civilizations*. New York: Penguin.
POPE. Stephen, APPLETON. Mike, WHEAL Elizabeth-Anne., 1991. *The Green Book*. London: Hodder and Stoughton.
PLANNING PORTAL., 2006. <www.planningportal.gov.uk> [Accessed 12 December 2006].
PRIOR, Josephine., 1999. Sustainable Retail Premises: an environmental guide to design, refurbishment and management of retail premises. BRE: London.
RAFTERY, John., 1991. *Principles of Building Economics*. London: Spon. (also Oxford: Blackwell)
RAPAPORT, Amos., 1990. *History and precedent in Environmental Design*. New York: Plenum Press.
RATTENBURY, Kester,. 2002. *The Fame Game. Building Design*, 25th January, pp14-15.
RAVEN, Darren., 2003 Doctor in the House, Technical: Building Pathology. *RIBA Journal*, January pp54-56.
RIBA, 2006. Sustainable Futures Group Manifesto <.www.architecture.com> [Accessed 10 November 2006]
RICHARDS, Ivor., TR HAMZAH & YEANG., 2001. *Ecology of the Sky*. Australia: Images Publishing Group.
RITCHIE Ian, 2005. Values. *Royal Academy lecture series* January 2005 <www.ianritchiearchitects.co.uk> [accessed 15 August 2006]
Robson,. Colin. 2002. *Real World Research* (2nd Edition) London: Blackwell.
ROSS, Tanya., 2003. Letter of the Law, Technical: Building Regulations. *RIBA Journal*, January, pp58-62.
ROAF, S., Fuentes, M. and Gupta, R. 2005 Solar Cities: The Oxford Solar Initiative. In Jenks M and Dempsey N. ed. Future Forms and Design for Sustainable Cities Oxford, Architectural Press. pp355-369.
ROAF, Sue,. 2004. *Closing the Loop; Benchmarks for Sustainable Buildings*. London: RIBA Enterprises.
RIBA Practice Bulletin No. 337 ref 45, February 15 2006
RIBA., 2006, *Sainsbury's supermarket; Greenwich Peninsular*. <www.architecture.com> [accessed 24 June 2006].

RICS. 2006. Green Value *website report* www.rics.org/greenvalue [accessed 8 June 2006]
SAPSFORD, Roger., 1999. *Survey Research.* London: Sage Publications Ltd
SARJA, Asko., 2002 *Integrated Life Cycle Design of Structures.* London, Spon.
SHANKS, Tom., Inertia Selling. Light May 2006 pp7
SHIELDS, Rob., Ed 1992. *Lifestyle Shopping; The Subject of Consumption* London: Routledge
ARCHITECT AND DESIGNER SERIES, 2004. *Shop Spec; Shopfitting Specification.* London: Buxton Business Press.
SILVER, Robert. S., 2006. Comfort Zone. *RED* May pp26-28.
SILVER, Robert. S. 2004. Shopfitting 2004. *RED* November. pp 49-51
SIMPSON, Veronica., 2006.Banana Boots, *RED* January pp15-16
SIMPSON, Veronica., 2005. Lucky Number, *RED* November pp10-14.
SMITH, Nigel. J., 1998. *Managing Risk in Construction Projects.* London: Blackwell.
SMITH, Peter. F., 2001. *Architecture in a Climate of Change: a Guide to Sustainable Design.* Oxford: Architectural Press.
SLESSOR, Catherine., 1997. *Eco-tech: Sustainable Architecture and High Technology.* London: Thames and Hudson.
SOLOMON, Alex 2003 *Profiting from Weather Information: an analysis of weather sensitivity in the retail sector.* London: Datamonitor
Statutory Instrument 2005 number 3468 Producer Responsibility Obligations (Packaging Waste) Regulations 2005
Statutory Instrument 2005 number 84 The Town and Country Planning (Use Classes) (Amendment) (England) Order 2005
Statutory Instrument 2006 No.1063 The Planning (Applications for Planning Permission Listed Buildings and Conservation Areas) (Amendment) (England) Regulation 2006.
STEEMERS, Mary., STEANE, Ann., 2004. Environmental Diversity in Architecture,. London: Taylor and Francis.
STIRLING, A., 2000. *On Precautionary and Science based Approaches to Risk Assessment and Environmental Appraisal*, in A. Klinke, O. Renn, A. Rip, A. Salo, A. Stirling (eds), On science and precaution in the management of technological risk, Volume II: Case studies, European Science and Technology Observatory, Sevilla, 19056/EN/2, July.

STIRLING, A., 2007. (Forthcoming). Environmental Appraisal as Decision Justification: Some problems and possible responses, in K. Begg, T. Horlick-Jones (eds), Environmental Decision-Making: perspectives, techniques, design. London: Edward Elgar.

SWANDT, D., R., 2005. *When managers become philosophers; Integrating learning with sense-making.* Academy of Learning and Education. 4(2): 193-212.

THE COMMISSION OF THE EUROPEAN COMMUNITIES, 2001.*Green Paper: Presenting a European Framework for Corporate Social Responsibility.* Brussels: The Commission of the European Communities.

TAYLOR, E., W., 1998 *The theory and practice of transformative learning; A critical review.* Ohio: Ohio State University Press:

THOMAS Randall., FORDAM, Max., and Partners.,1996. *Environmental Design.* UK: Spon.

TODD, N. J., TODD, J., 1994. *From Eco-cities to Living Machines, Principles of Ecological Design.* USA: North Atlantic Books.

TOYNE., Paul. BLAMEY, Claudine, 2006. British Land Company PLC. Article 13 and CBI; CSR Case Studies Series. June.

TRAVERS, Max, 2001, Qualitative Research through Case Studies. London: SAGE Publications Ltd.

TUCKER, Johnny., 2006. Retail Revolution. *FX* May. p65-68.

TURNER, R K., 2006. Sustainability Auditing and Assessment Challenges. Building Research and Information. Volume 34, Number 03 May/ June. p197-200.

TURNER R. Kerry, PEARCE David, BATEMAN Ian, 1994, *Environmental Economics; An Elementary Introduction.* Hemel Hempstead: Harvester Wheatsheaf.

VALE, Robert., VALE, Brenda., 1991. *Towards a Green Architecture.* London: RIBA Publications.

VALE, Robert., VALE, Brenda., 1996. *Green Architecture: Design for a Sustainable Future.* 1st Ed. London: Thames and Hudson.

VAN DE RYN, Sin., COWAN, Stuart., 1996.*Ecological Design.* USA: Island Press.

YIN Robert K. 2003 (3rd Edition). Case Study Research Design and Methods. California: Sage Publications Ltd.

VITRUVIUS., 1960 Edition. The Ten Books on Architecture. New York: Dover Publications

WARHURST Alyson 1998 *ESRC Global Environmental change programme Developing a Sustainable Economy: Towards a Proactive Research Agenda.* University of Bath.

WCED, 1987. *Our Common Future (The Brundtland Report).* Oxford: Oxford University Press.

WEIGHT, David, 2005. Whole-life costs: datafile. *Building* 24 June pp66-69.

WHITE, Rodney. R. 2004. Managing and Interpreting Uncertainty for Climate Change Risk. *Building Research and Information.* Volume 32, number 5/ September-October. pp438-448.

WILLIAMS, Bernard., 2001, *Facilities Economics in the European Union.* Bromley: Building Economics Bureau Ltd.

WILLIAMS, Malcolm., MAY, Tim., 1996. *Introduction to the Philosophy of Social Research.* London: UCL Press.

WOOD, G., BECKER, J., 2005. Screening Development proposals for EIA Journal of Environmental Planning and Management. Vol. 48 No. 3 May. Routledge. pp359.

WOOD, Steve., LOWE Michelle,. WRIGLEY, Neil. 2006. Life After PPG6 – Recent food retailer responses to planning regulation tightening. *International Review of Retail, Distribution and Consumer Research.* Volume 16, Number 1/ February.

WOOLLEY, Tom., BEVAN, Rachael., 2006. *Case Study 2: Housing Development Insulation Specifications.* Available at: <www.balancedvalue.com> [Accessed 18 May 2006].

WOOLLEY, Tom., 2000. *Green Buildings Handbook. London: Spon.*

WRAP., 2006. <www.wrap.org.uk> [Accessed 12 December 2006]

WORPOLE, Ken.,2000 *The Value of Architecture: Design Economy and the Architectural Imagination.* London: RIBA Publications.

YEANG, Ken., 1996. *The Skyscraper Bioclimatically Considered.* UK: Academy Editions.

YEANG, Kenneth., 1995. *Designing with Nature.* London: McGraw Hill.

Table of Appendices

Sustainable Retailing: Construction Industry Professionals Survey

This survey is part of a research project based in the School of Architecture Planning and Landscape at the University of Newcastle upon Tyne and managed from Simons Design Ltd. The aim of the research is to provide information to be used in the development of better environmental and design assessment tools for retail and shopfitting projects.

The survey has been designed to collect information about current practices in the retail sector of the construction industry. The survey asks questions about the respondent, their company, a recently completed project and the design and environmental values of the retail client involved. Your knowledge and experience in this field is valuable to help with this research.

Please insert your response, delete yes or no or insert a tick as requested for each question. The survey can be completed as a word document and attached to a return e-mail or faxed. The survey is confidential and will be used to compile information about trends and practices in retail construction

Please return to **rosi_fieldson@simonsgroup.com** *or* **fax: 01522 882601** *or post to:* **R Fieldson, Simons Design, Witham Park House, Waterside South, Lincoln, LN5 7JP (tel: 01522 882620)**

SECTION 1: About you and your company.

1. About you;

1	What is your job title?	
2	How many years have you held this job title?	
3	Is your role managerial?	**Yes / no**
4	How many years have you worked for your current employer?	
5	How many years have you been working in retail construction?	

2. About your company;

1	What is the main business of your company? (i.e. Architectural Practice, Consultancy, Shopfitting)	
2	If Multi-disciplinary, what other departments/teams are there?	
3	How many people are employed in the main business?	
4	Approximately what percentage of the company's work is in the retail sector?	
5	What other sectors does the company work in?	
6	Is there a company environmental policy?	Yes/no
7.	Do you have any influence over the company's environmental policy?	Yes/no

3. Would you describe your company's environmental policy as;
Please tick (or paste the attached tick ✓ if completing the form as a word document)

1	Passive or no specific policy (Achieving legislative requirements)	
2	Active (Trying to reduce impact on the environment by exceeding legislative requirements and guidelines)	
3	Proactive (Actively looking to find better ways to reduce impact on the environment though research, analysis and development)	
4	Industry Leader (Providing the highest standards of environmental impact reduction and performance)	
5	Don't know	

SECTION 2: A recent retail project

Please use your most recently completed retail project for all the questions in Section 2;

4. Client's main retail category; Please tick (or paste the attached tick ✓)

1	A1 Shops	Mixed Retailing		Furnishing / DIY		Food/ wine/ beer	
		Electrical & Electronic		Clothing & Footwear		Motor Services	
		Telecoms		Sports		Toys/gifts/ cards	
		Stationers, newsagents & books		Music Video entertainment		Health & beauty	
		Travel Agency		Mail Order		Other	
2	A2 Financial and Professional Services	Bank		Estate Agent		Agency of other type	
		Building Society		Betting Office		Other	
3	A3 Food and Drink	Restaurant		Public House		Snack bar	
		Fast Food		Cafe		Other	
4	D8 Storage and distribution	Cash & Carry		Wholesale Warehouse		Other	
5	D2 Assembly and Leisure	Cinema		Bingo		Other	

5. If you have ticked "other" for retail category in question 3, please specify the nature of the business.

6. Please tick one category that most accurately describes the nature of the project.

New shell		New fit out and shell		New fit out in shell by others	
Extension or external works to previously occupied shell for same client (including fitting out)		New Fit out in shell previously occupied by others (including change of use)		Interior refurbishment only of shop fit for same client	

7. About the project;

1	What was your (or your company's) role in the project?	
2	How many weeks was the pre-contract stage of the project?	
3	How many weeks was the project "on site"?	
4	What form of contract was used?	
5	What was the contract sum?	
6	What was the gross floor area in square feet (or metres)?	
7	What was the retail floor area square feet (or metres)?	
8	What was the situation of this particular project? (i.e. mall, street, retail park)	
9	Was the project part of a roll-out programme?	Yes/no
10	If yes, how many stores have been completed by your company previously?	
11	How long in years is the store expected to be in use before refit or relocation?	
12	Were air-conditioning services provided in the contract?	Yes/no
13	If not were they provided by the previous tenant, by the landlord or none installed?	
14	Are electrical, gas and water services metered or by service charge?	
15	Is there a facilities manager?	Yes/no
16	If not, who looks after the day-to-day operations and maintenance?	
17	Is there a maintenance contract?	Yes/no
18	If so, is it planned or reactive?	
19	Did the works include modifications to comply with DDA or part M 2004?	Yes/no

8. About the design:

1	Was a concept design by a separate designer to the main architect used?	Yes/no
2	Were standard details used?	Yes/no
3	If so, who were they prepared by?	
4	Please describe any changes made to the concept or standard details to accommodate special site circumstances (i.e. planning or listed building requirements, landlord's requirements etc)	

9. Were any or the following analytical tools or methods employed to help in project evaluation and decision-making and at what stage in the project were these methods used? Please tick (or paste the attached tick ✓)

		Briefing/feasibility	Design Stages	Pre-Tender product information	Post -tender evaluation	During works on site	Post completion feedback
1	Intuitive/reasoning/discussion within design team						
2	Value Engineering						
2	Cost Benefit Analysis						
3	Whole Life Costing						
4	Life Cycle Analysis						
5	Multi-criteria analysis						
6	BREEAM for Retail projects						
7	In house method*						
8	Other commercially available package*						

10. * Please describe any in house method or name the commercially available package in this space:

SECTION 3: Client Values.

Using the same client as for the project described in section 2;

11. What is your understanding of your client's design priorities for their project(s)? (Please place in order of importance, 1 being highest).

1	Minimising capital cost £/m^2	
2	Maximising resale or rental value	
3	Maximising store layout efficiency (net to gross)	
4	Maximising Turnover/m^2	
5	Linear metres of display	
6	Minimising maintenance	
7	Design impact	
8	Image, positioning and Branding	
9	Layout flexibility and demountability	
10	Store finish quality	
11	Customer comfort	
12	Other, please specify;	

12. What do you believe to be your clients main motives in making design decisions based on sustainability issues? Please rank as many that apply in order of priority, 1 being highest.

1	Not considered relevant	
2	Saving running costs	
3	Taxation gains	
4	Marketing tool	
5	Corporate responsibility	
6	Planning Gain	
7	Reducing fossil fuel use	
8	Reducing waste	
9	Promoting sustainability/biodiversity amenity value locally	
10	Other, please specify;	

13. What in your opinion is most likely to change your clients' priorities for a similar project in the future? Please rank as many that apply in order of priority, 1 being highest.

1	Increased climate change levy/fuel costs	
2	Attractive tax incentives/grants available	
3	Customer demand	
4	Employee demand	
5	Stricter planning controls	
6	Stricter building control requirements on services	
7	Increased waste disposal charges	
8	Local lobbying	
9	Nothing	
10	Other, please specify	

14. Client's sustainability policy. Please tick (or paste the attached tick ✓) actions that are currently in place now or expected/proposed in the next couple of years, in three to 10 years time or more than 10 years. Please leave a blank if you are not aware of client's policy on any particular aspect listed.

		Currently in place	In 1 to 2 years	3 to 10 years	+ 10 years
Economic Considerations	Whole life cost management of retail facility				
	Demographic analysis for sales growth				
	Marketing using environmental issues for sales growth				
Social Considerations	Community/social responsibility projects				
	Access and family friendly policy				
	Responsible stock sourcing				
Environmental Considerations	Life cycle costing of building materials				
	Waste management and recycling (of packaging etc)				
	Responsible stock sourcing				

Thank you for your time in completing this questionnaire

Construction Professionals Survey Raw Data

section	Qno.	sub-question	fax 01	fax 02	fax 03	fax04	fax05
1							
	1						
		1	architect	Managing Director	Operations Director	Architect	Director
		2	director 6	20	2	20	1
		3	yes	yes	yes	yes	yes
		4	14	29	4	self-employed	14
		5	17	17	20	15	4
	2						
		1	Architectural practice	Architectural Practice	Shopfitting and facilities management	Architectural Practice	Architectural Practice
		2	0	0	coatings, joinery, bespoke furniture	none	planning, interiors, surveying, graphics
		3	12	35	450	9	190
		4	50%	35-50%	75%	30%	17%
		5	office, leisure, cultural, residential	offices , TV, hotels, telecoms, housing	commercial, education,housing, pulic secter	housing. Commercial, leisure	commercial, education, health, residential
		5	yes	yes	yes	none	yes
		7	yes	yes	no	yes	yes
	3		3	2	2	2	3
2	4		A1 mixed retailing	A1 clothing and footwear	A1	A1Clothing and Footwear	A2 bank
	5		0	0	supermarket		0
	6		6	6	4	5	6
	7	1	Architect designer	Lead Architect	Main Contractor	Architectural Design	Designer
		2	10	10	2	24	5
		3	6	12	15	24	4
		4	in-house special	JCT intermediate	D&B	JCT98	JCT
		5	£700,000	£1,500,000	£600,000	£1500000	£250000
			£1538.46m2	£2,500	£150		
		6	455m2	600m2	3995m2	743.2m2	357m2
		7	0	450m2	2434M2	418m2	164m2
		8	Department store	High street	street	street	mall
		9	Yes	no	yes	yes	yes
		10	1	0	3	1	250
		11	unknown	unknown	5	5	unknown
		12	yes	yes	no	yes	no
		13	0	0	existing	0	none installed
		14	no	metered	metered	metered	metered
		15	unknown	no	yes	no	no
		16	store	store	store-based	manager	branch manager
		17	no	yes	yes	yes	yes
		18	0	planned	unknown	not known	reactive
		19	yes	no	yes	no	yes
	8	1	no	yes	no	no	main architect
		2	partly	yes	yes	no	yes
		3	Architect	Design Architect	client	0	main architect
		4	none	none	external works required Planning permission and building Warrant	door design detailing for planning	none installed
	9	1	b	abc	b	a	b
		2		bcd	c	b	bd
		3	c	d	c		d
		4	b		b		a
		5	b		b		a
		6					
		7					
		8			e		
		9			e		
	10		none	none	construction methods review and change management	0	
3	11		equal 4, 5, 6, 7, 8, 10 and 11	7, 1, 10,3, 5	1,3,4,8,10,1,7,5,9,6,2	8,7,10,4,9,1,4,5,6,3,2	equal1,3,8,11
	12		1,5,3	4, 1	9,4	2,8	5
	13		6	2, 6, 5, 4	3, 4	2,1,3,4,7,=(10th)5,6,8,9	1,2,3,10 (competition),6,5,7,4
	14	1	a				b
		2	b				
		3					
		4					a
		5	a				a
		6					
		7	a				b
		8	a				a
		9		did not complete	did not complete	did not complete	

Construction Professionals Survey Raw Data

section	Qno.	sub-question	e01	e02	e03	e04	e05	e06	e07
1								Debenhams	Debenhams
	1							Ian Hildreth	Mark Baxter
		1	senior project designer	architect	Project Architect	MD	Construction Manager	Contracts Director	Cost consultant
		2	.5	7	6	15	.5	9	27
		3	yes	yes	no	yes	yes	yes	yes
		4	8	4	7	32	5	12	27
		5	15	8	7	20	4	21	20
	2								
		1	Architectural practice	Architectural Practice	Architectural Practice	Interior Design	Main Contracting, building	Shopfitting and construction	Cost and project management
		2	Interior Design	0	0	0	Architectural, M&E environmental	Joinery, CAD, maintenance	legal, risk and value management, consultancy, spec writing, design management, engineering cost services.
		3	23	15	12	6	500	170	1000+
		4	50-60%	25%	45%	35%	75%	75%	5-10%
		5	residential, commercial, manufacturing, Heritage, distribution, transport, pharmecultical leisure.	residential commercial leisure	Healthcare, education	leisure, residential, airport	Health, leisure, commercial	leisure, finance, food, office, DIY	most private and commercial sectors
		6	no	no	yes	yes	yes	yes	yes
		7	no	no	no	yes	no	yes	no
	3		1	1	2	2	4	2-4	3-4
2	4		A1 mixed with A3 cafe	A1 clothing and footwear	A1 mixed retailing	A1 mixed retailing with A3 restaurant	A1 furnishing DIY	AI mixed	A1 mixed
	5		0	0	0	0	0	0	0
	6		6	5	3	6	2	3	2
	7	1	D&B architect	architect	design team leader	Retail strategy and interior design	Main contractior	Principal contractor	Cost management
		2	26	20	50	38	10	20	3 years
		3	34	16	20	12	28	36	40weeks
		4	D&B	JCT 98	JCT	D&B hybrid	JCT with quantities	JCT	JCT private with quants
		5	£11,000,000	£1,350,000	£5,000,000	£1200000	£7200000	£12000000	£12000000
			£1,158	£3,230	£625	1200	705.88	717.03	
		6	9500m2	418m2	8000m2	1000m2	10200m2	16720m2	16720m2
		7	7500m2	325m2	6000m2	1000m2	930m2	10960m2	10960m2
		8	town centre mall	street	street	high street	retail park	Mall	Mall
		9	no	no	yes	no	yes	yes	yes
		10	0	0	0	0	3	6	15
		11	no known	5	3	10-15	15	5-10	not known
		12	yes	yes	no	yes	yes	yes	yes
		13	0	0	no	0	0	0	0
		14	not known	service charge	metered	yes	yes	yes (Metered)	don't know
		15	not known	no	yes	yes	no	yes	in-house
		16	not known	contract	0	Store service manager	client maintenance (B&Q properties	0	0
		17	not known	yes	yes	yes	no	yes	yes
		18	not known	planned	reactive	not known	0	planned	don't know
		19	no	yes	yes	yes partly	yes	yes	yes
	8	1	yes	no	no	yes	no	No	yes
		2	no	no	no	no	no	yes	yes
		3	0	0	0	respondent ID	0	client	client
		4	0	0	0	for listed building	0	0	0
	9	1	abcde	b	abe	abcdef	b	bdef	
		2	abcde	c	bcde	d		cde	bde
		3			a		bd	d	
		4			ab				
		5						cf	
		6							
		7					f		
		8							
		9							e
	10					design protocals for brief criteria, consistency of approach, buildability, maintenability, life expectancy	air testing, thermgraphic testing and inspection by BSRIA		
3	11		4,5,3,1,7,8.10,8,9,6,2	7,8,10,5,9,1,6,11,4,3,11	4,3,5,10,9,8,11,1,7,10	7=8, 9=4, 10=11=3, 1=5=6	1,2,8,7,3,4,5,11,10,9	1,3,5,6,8,9,7,10,11	4,1,8,10,3,2,7,9,11,5,6
	12		1	4,3,2,6,5,8,9,7	1,2,4,5,3,6,7,8,9	4,6,5,2	5,9,6,8,4,3,2,7	2,3,54,8	1,8,3,4,7,5,6,9
	13		3,5,6	,	3,5,3,4,7,1,2,4	3	2,3,5,7,8,4=6	3,2	1,7,1,2,4,6,5,8,9
	14	1			e				b
		2			e				e
		3		b					b
		4			e				b
		5			e				e
		6		c					e
		7							b
		8							b
		9	did not complete	b		did not answer	did not answer	did not answer	b

Comparing opinions of three consultants from one project					
section	Qno.	sub-question	e06	e07	08
1			Department store	Department store	Department store
	1				
		1	Contracts Director	Cost consultant	Project Architect
		2	9	27	5
		3	yes	yes	no
		4	12	27	8
		5	21	20	6
	2				
		1	Shopfitting and construction	Cost and project management	Architectural Practice
		2	Joinery, CAD, maintenance	legal, risk and value management, consultancy, spec writing, design management, engineering cost services.	Interior design
		3	170	1000+	25
		4	75%	5-10%	50%
		5	leisure, finance, food, office, DIY	most private and commercial sectors	commercial, leisure, heratage and conservation, pharmecuetical, housing
		6	yes	yes	yes
		7	yes	no	no
	3		2-4	3-4	2
2	4		A! mixed	A1 mixed	A1 mixed and A3
	5		0	0	0
	6		3	2	3
	7	1	Principal contractor	Cost management	Project Architect
		2	20	3 years	18months
		3	36	40weeks	40weeks
		4	JCT	JCT private with quants	JCT/negotiated
		5	£12000000	£12000000	£12000000
		6	16720m2	16720m2	16720m2
		7	10960m2	10960m2	10960m2
		8	Mall	Mall	mall
		9	yes	yes	yes
		10	6	15	2
		11	8-10	not known	10years
		12	yes	yes	yes
		13	0	0	0
		14	yes (Metered)	don't know	metered
		15	yes	in-house	store
		16	0	0	0
		17	yes	yes	yes
		18	planned	don't know	planned/reactive
		19	yes	yes	no (pre dates legislation)
	8	1	No	yes	yes
		2	yes	yes	yes
		3	client	client	client
		4	0	0	0
	9	1	bdef		bcde
		2	cde	bde	bde
		3	d		f
		4			f
		5	cf		
		6			
		7			
		8			
		9		c	
	10				
3	11		1,3,5,6,8,9,7,10,11	4,1,8,10,3,2,7,9,11,5,6	1,8,4,3,11,10,7,5,9,2,
	12		2,3,54,8	1,8,3,4,7,5,6,9	2,8,3,4,5,6,9,7
	13		3,2	1,7,1,2,4,6,5,8,9	5,6,4,3,2,1,7,8
	14	1		b	c
		2		a	b
		3		b	c
		4		b	b
		5		a	a
		6		a	b
		7		b	b
		8		b	a
		9	did not answer	b	b-c

QUESTIONNARE

Anonymous results are to be complied by Simons Design

1. Would you describe your company's environmental policy as;

1	Passive (Achieving legislative requirements)	
2	Active (Trying to reduce impact on the environment by exceeding legislative requirements and guidelines)	
3	Proactive (Actively looking to find better ways to reduce impact on the environment though research, analysis and development)	
4	Industry Leader (Providing the highest standards of environmental impact reduction and performance)	
5	Don't know	

2. How would you order these design priorities for new stores? (Please rank in order of importance, 1 being highest).

1	Minimising capital cost £/m^2	
2	Maximising resale or rental value	
3	Maximising store layout efficiency (net to gross)	
4	Maximising Turnover/m^2	
5	Linear metres of display	
6	Minimising maintenance	
7	Design impact	
8	Image or brand repositioning	
9	Layout flexibility and demountability	
10	Store finish quality	
11	Customer comfort	
12	Other (please specify)	

3. How would you rank the following sustainability issues for importance in the development of new stores? (Please rank in order of importance, 1 being highest.)

1	Not considered relevant	
2	Saving running costs	
3	Taxation gains	
4	Marketing tool	
5	Corporate responsibility	
6	Planning Gain	
7	Reducing fossil fuel use	
8	Reducing waste	
9	Promoting sustainability/biodiversity amenity value locally	
10	Other (please specify)	

4. **What in your opinion is most likely to change the priorities listed above for a similar project in the future? (Please rank in order of importance, 1 being highest.)**

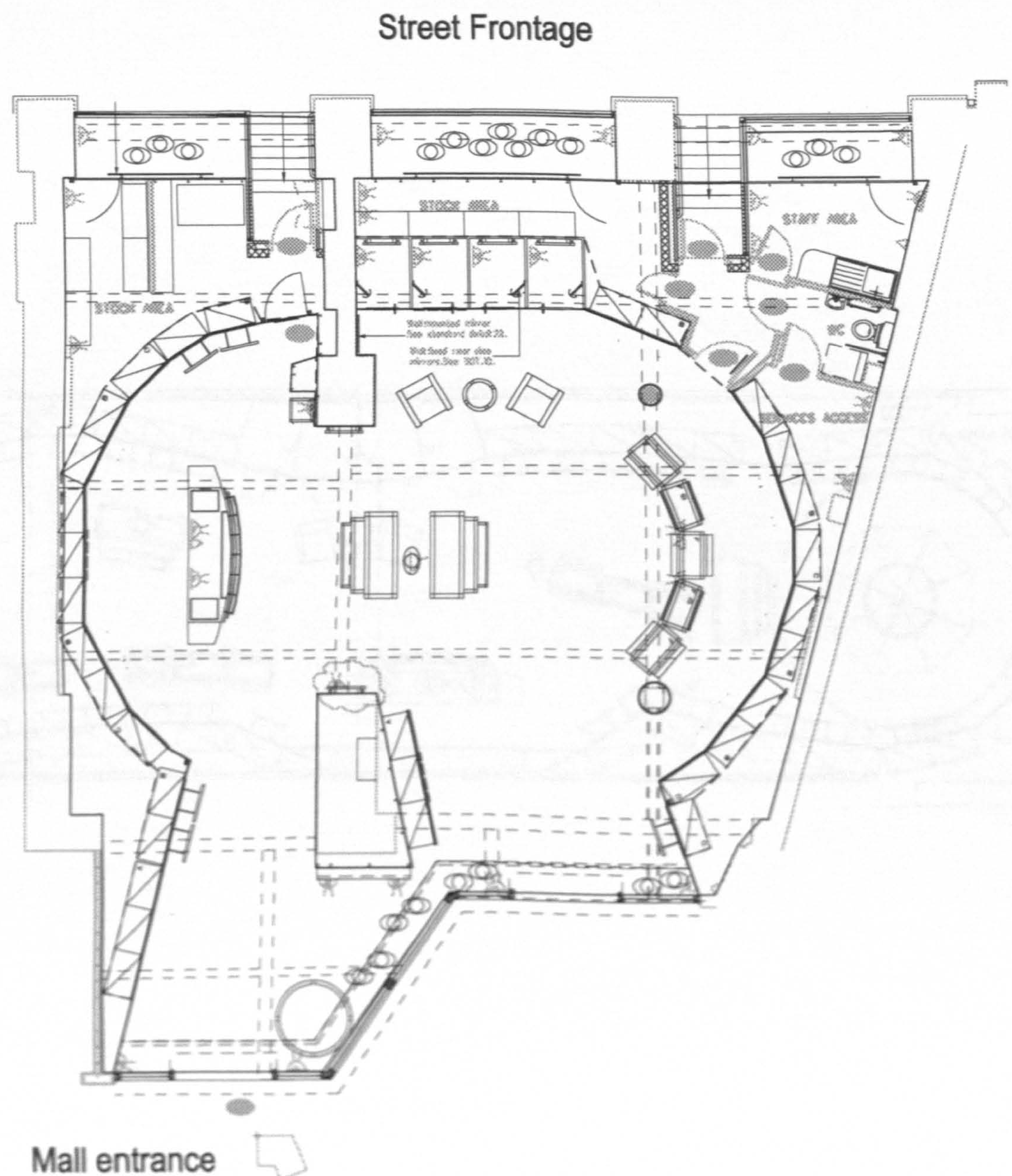
1	Increased climate change levy/fuel costs	
2	Attractive tax incentives/grants available	
3	Customer demand	
4	Employee demand	
5	Stricter planning controls	
6	Stricter building control requirements on services	
7	Increased waste disposal charges	
8	Local lobbying	
9	Nothing	
10	Other (please specify)	

5. **CSR Policy. Please indicate when the following policies might come into action.**

		Current	1-2 years	3 to 10 years	10 years +
Economic Considerations	Whole life cost management of retail facility				
	Demographic analysis for sales growth				
	Marketing using environmental issues for sales growth				
Social Considerations	Community/social responsibility projects				
	Access and family friendly policy				
	Responsible stock sourcing				
Environmental Considerations	Life cycle costing of building materials				
	Waste management and recycling (of packaging etc)				
	Responsible stock sourcing				

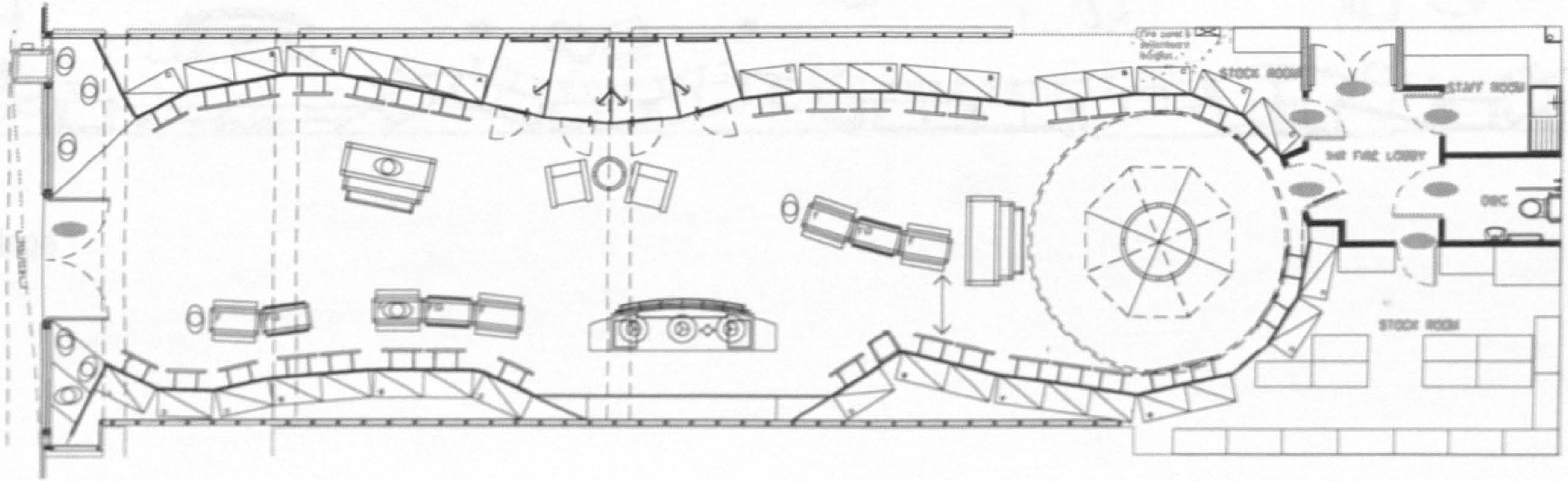
6. **Comments**

Thank you for your time taken in completing this questionnaire

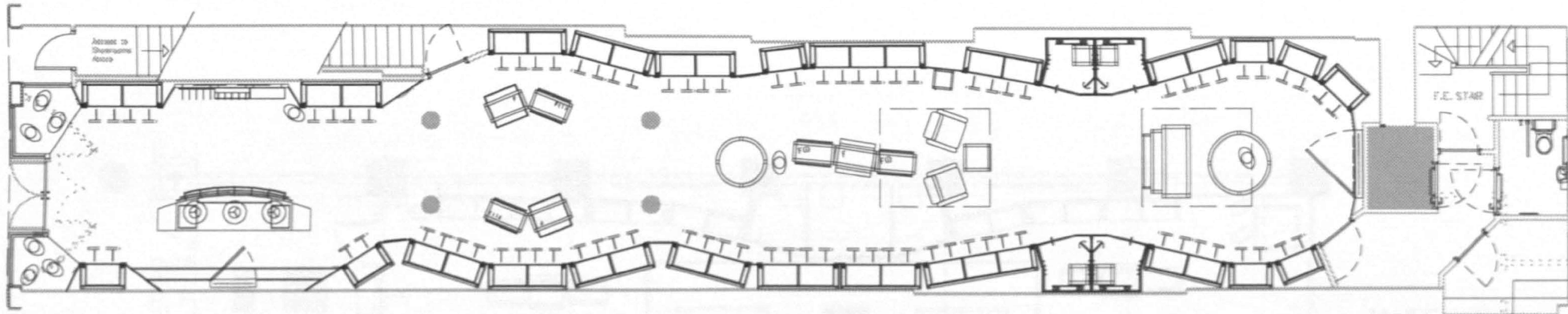

Street Frontage
STOCK AREA
STAFF AREA
STOCK AREA
WC
SERVICES ACCESS
Mall entrance

Case Study 1

Mall frontage

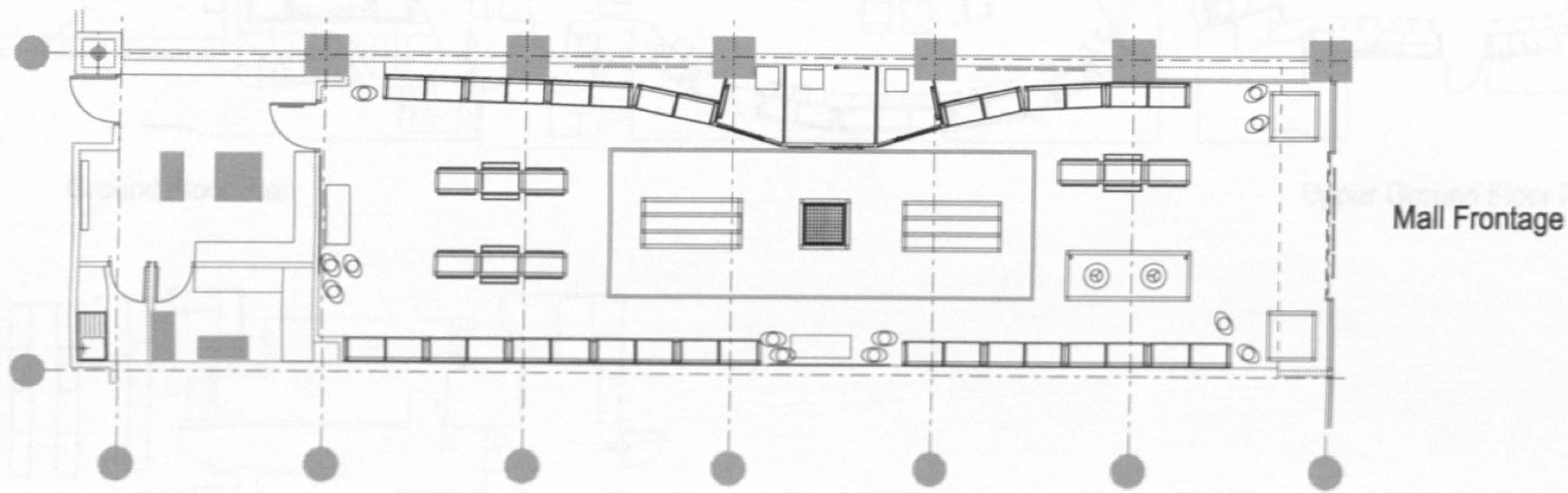


Case Study 2



Street Frontage

Case Study 3

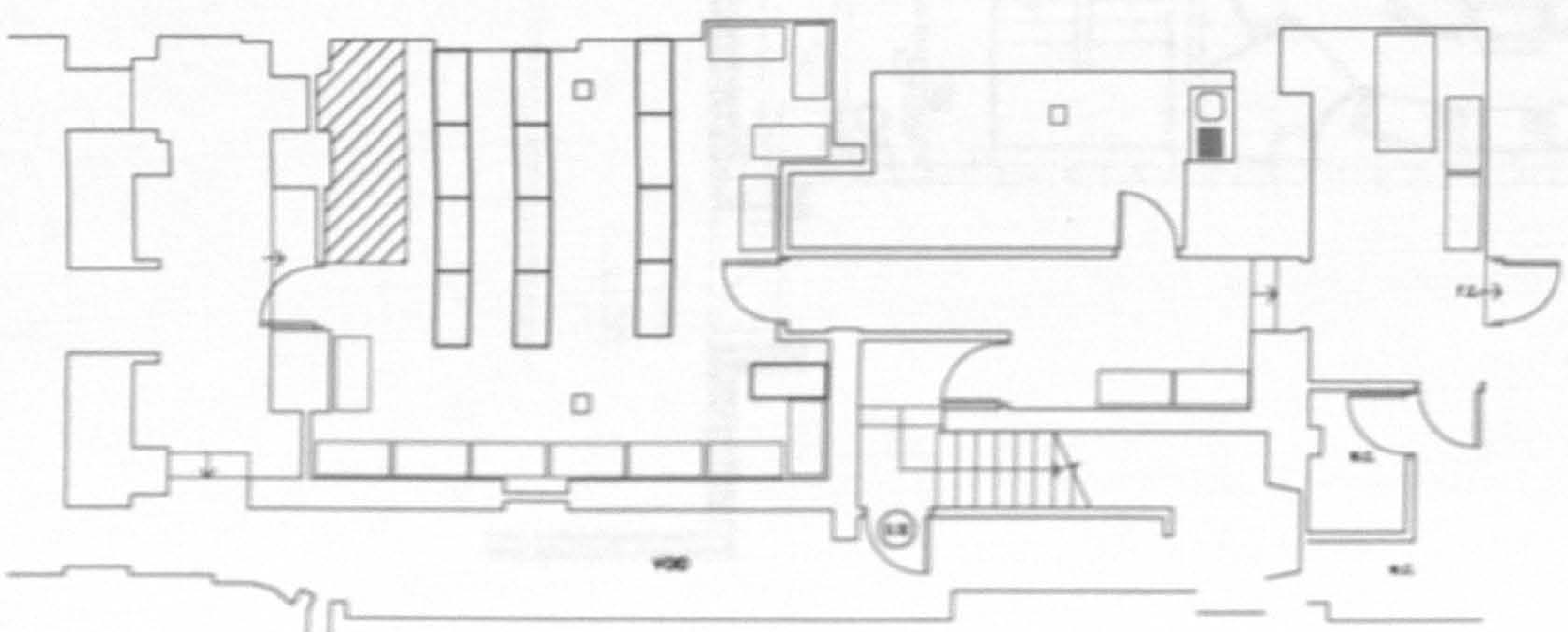


Case Study 4

Street Frontage

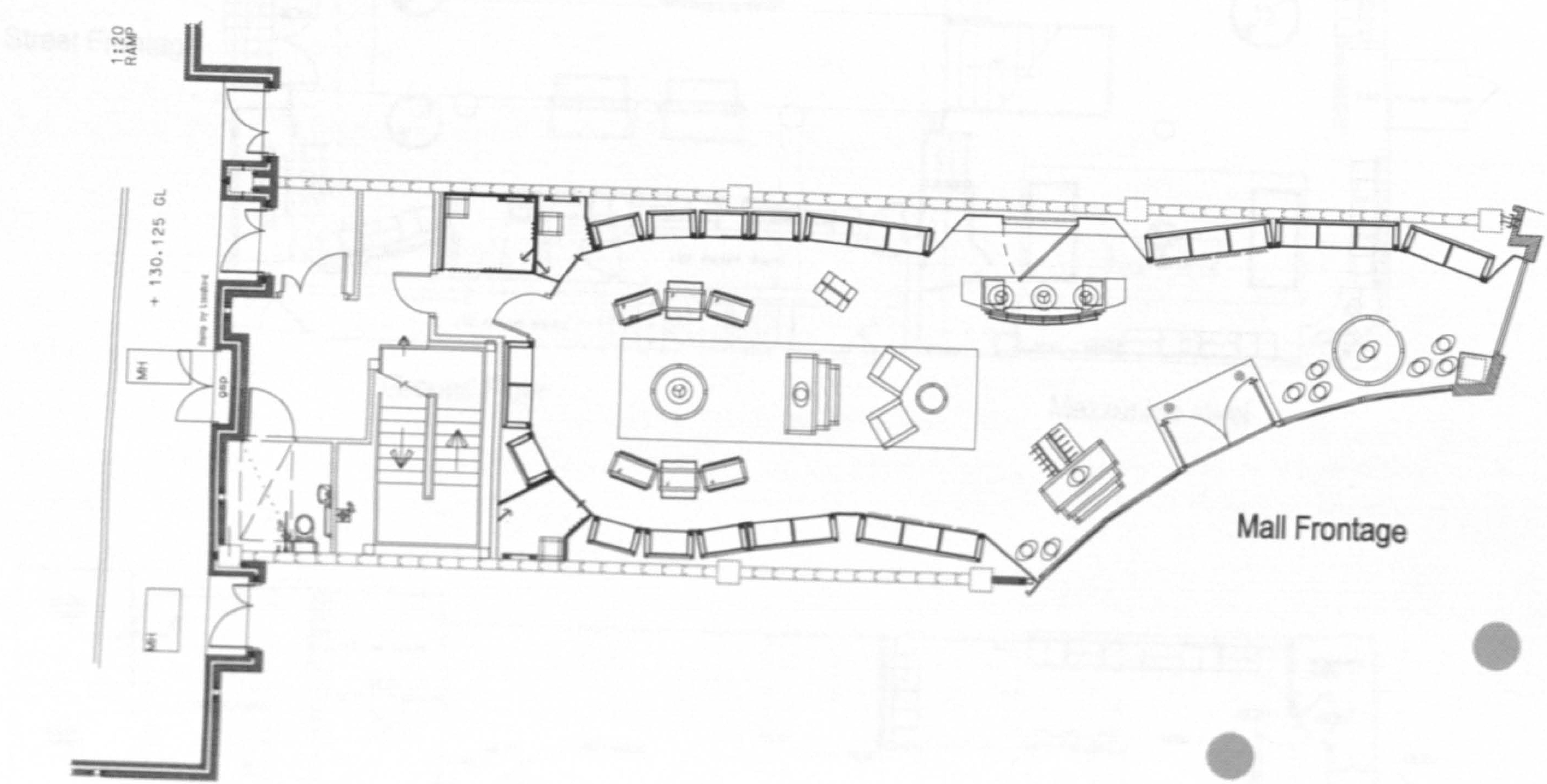
Ground Floor Plan

Upper Ground Floor Plan



Basement Plan

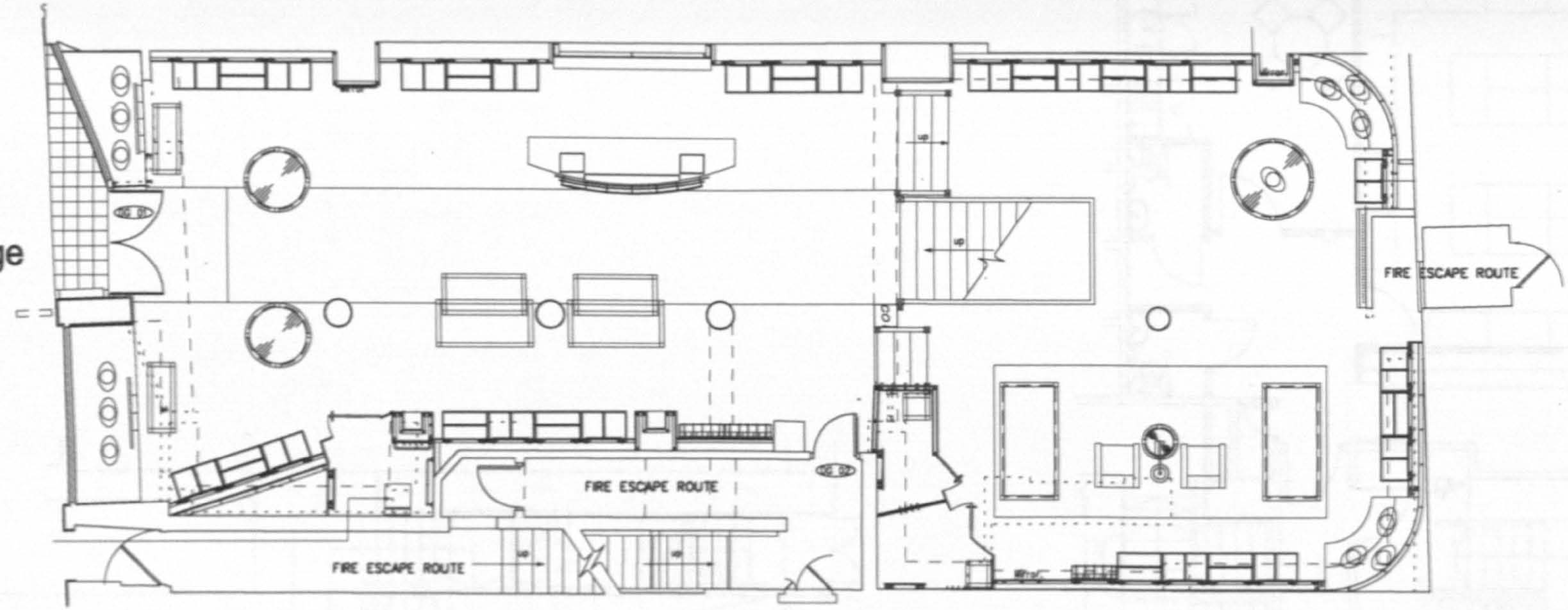
Case Study 5



Case Study 6

Case Study 7

Street Frontage

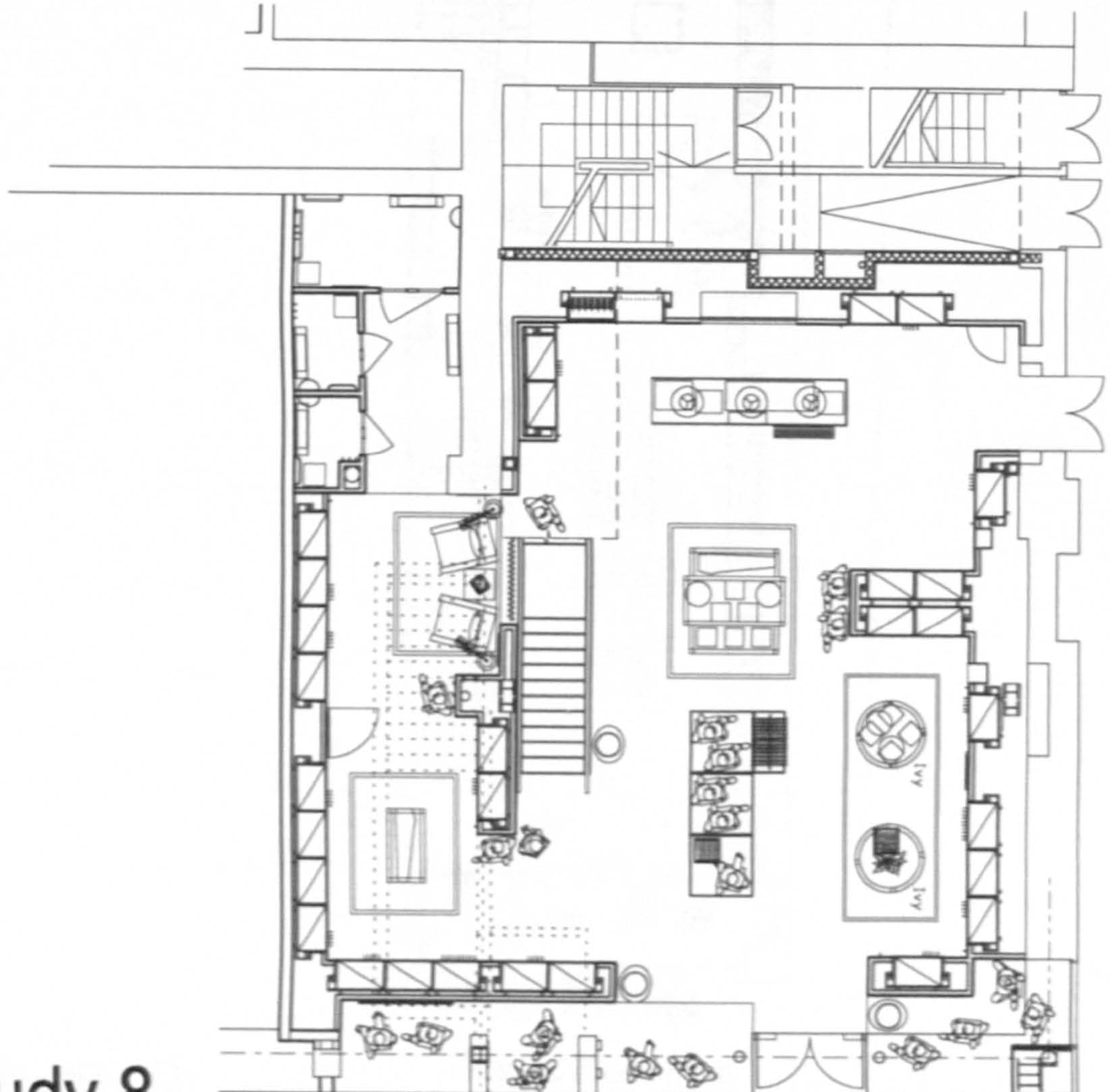


Ground Floor

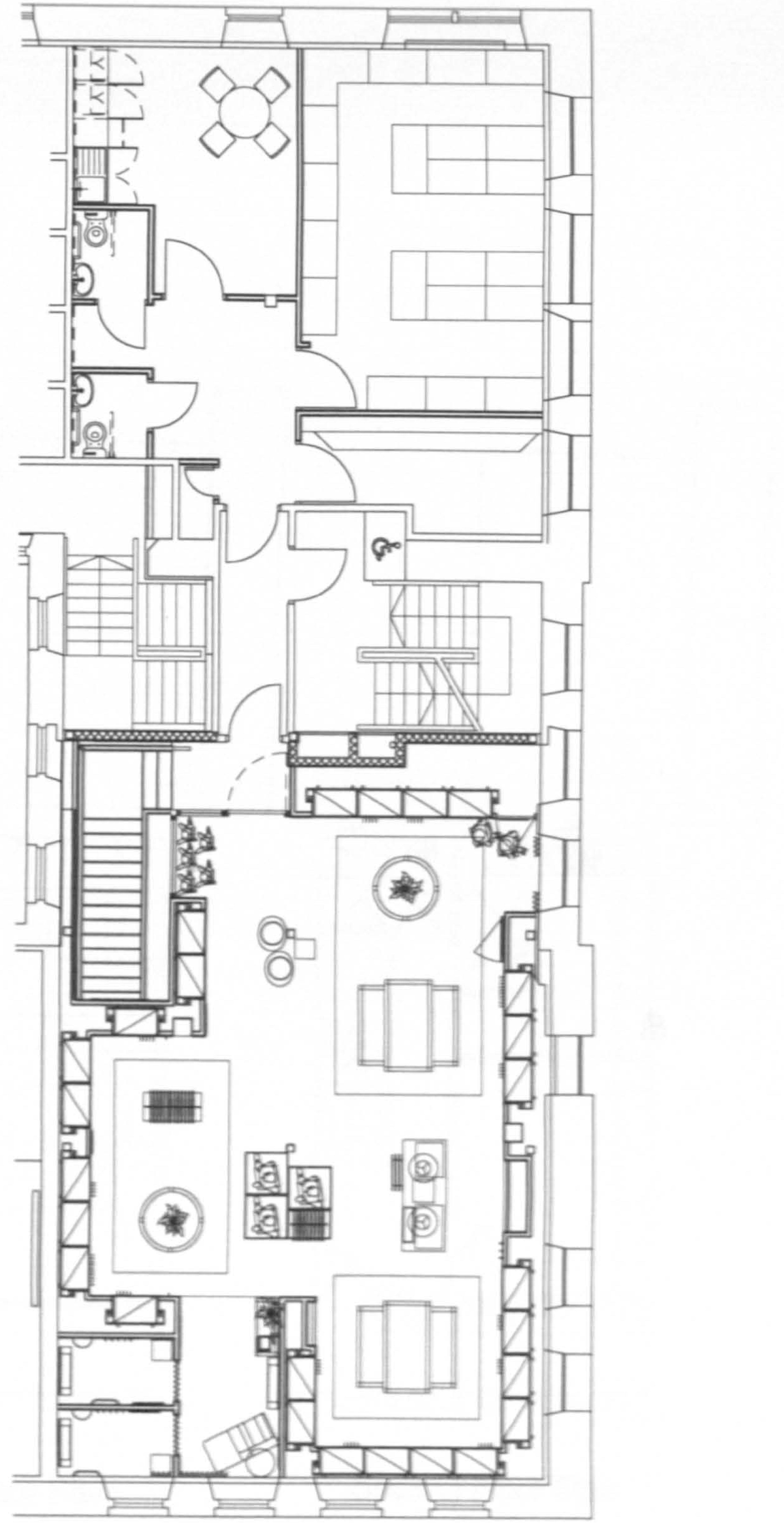
Mezzanine level

Basement plan

Case Study 8

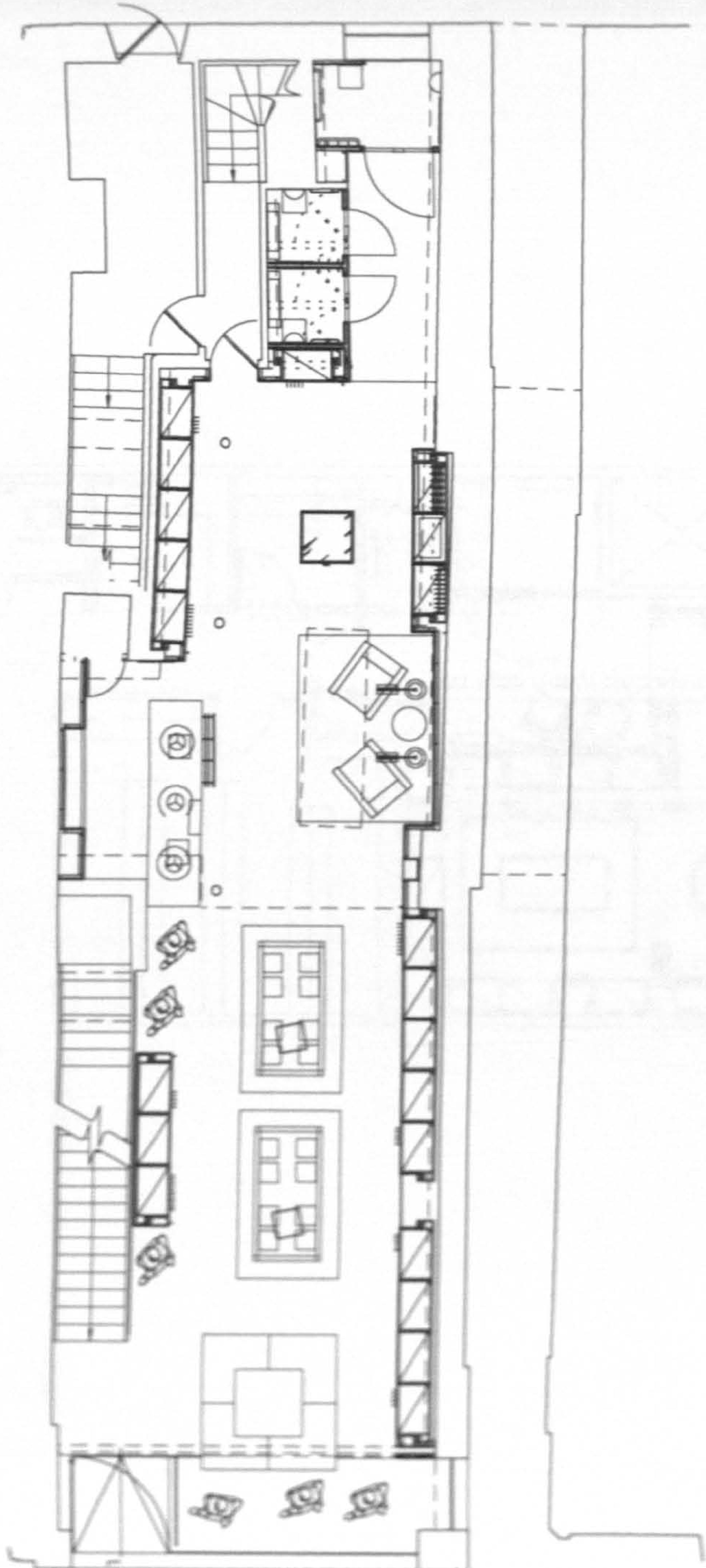


Ground Floor Plan



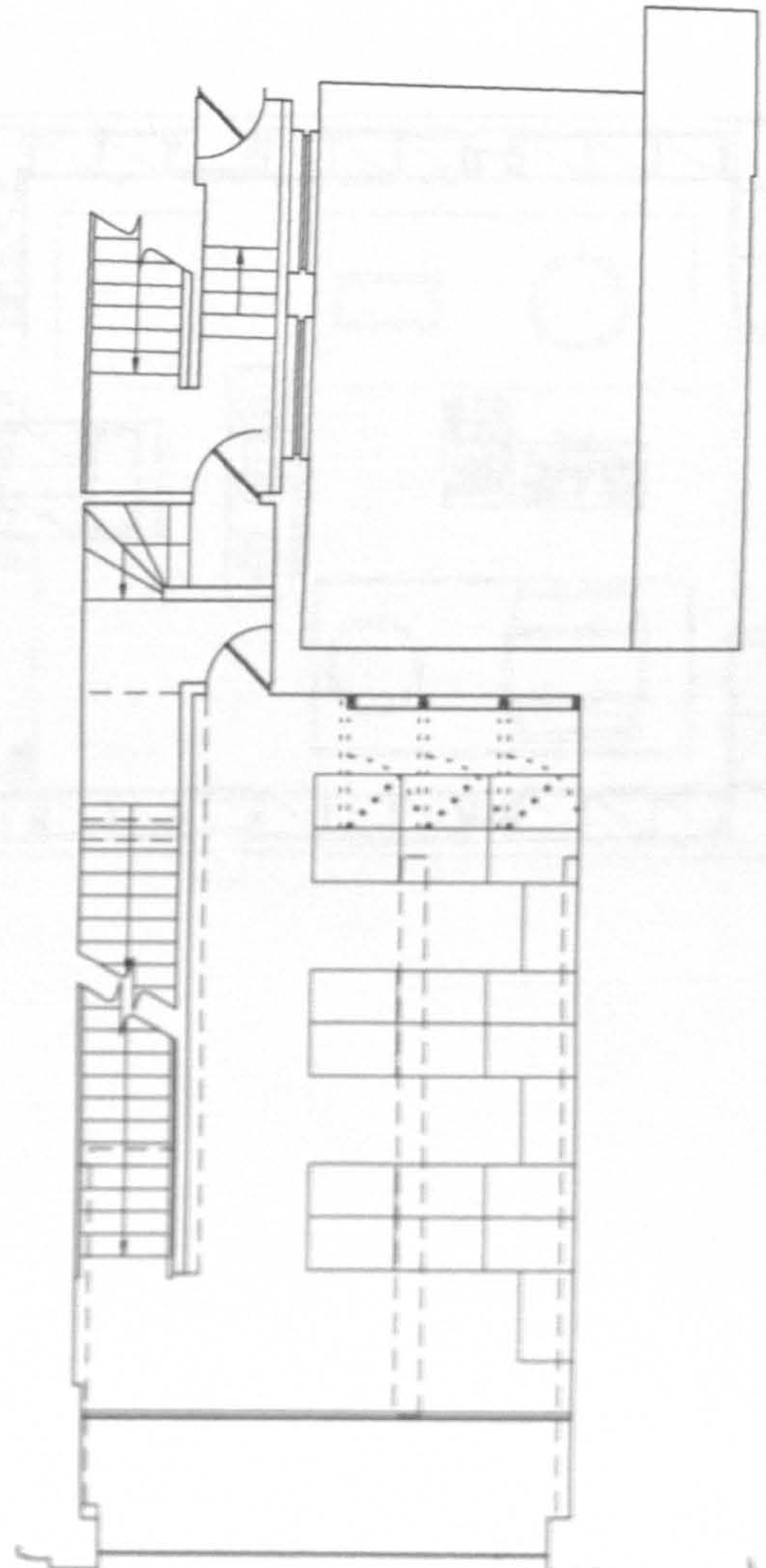
First Floor Plan

Case Study 9

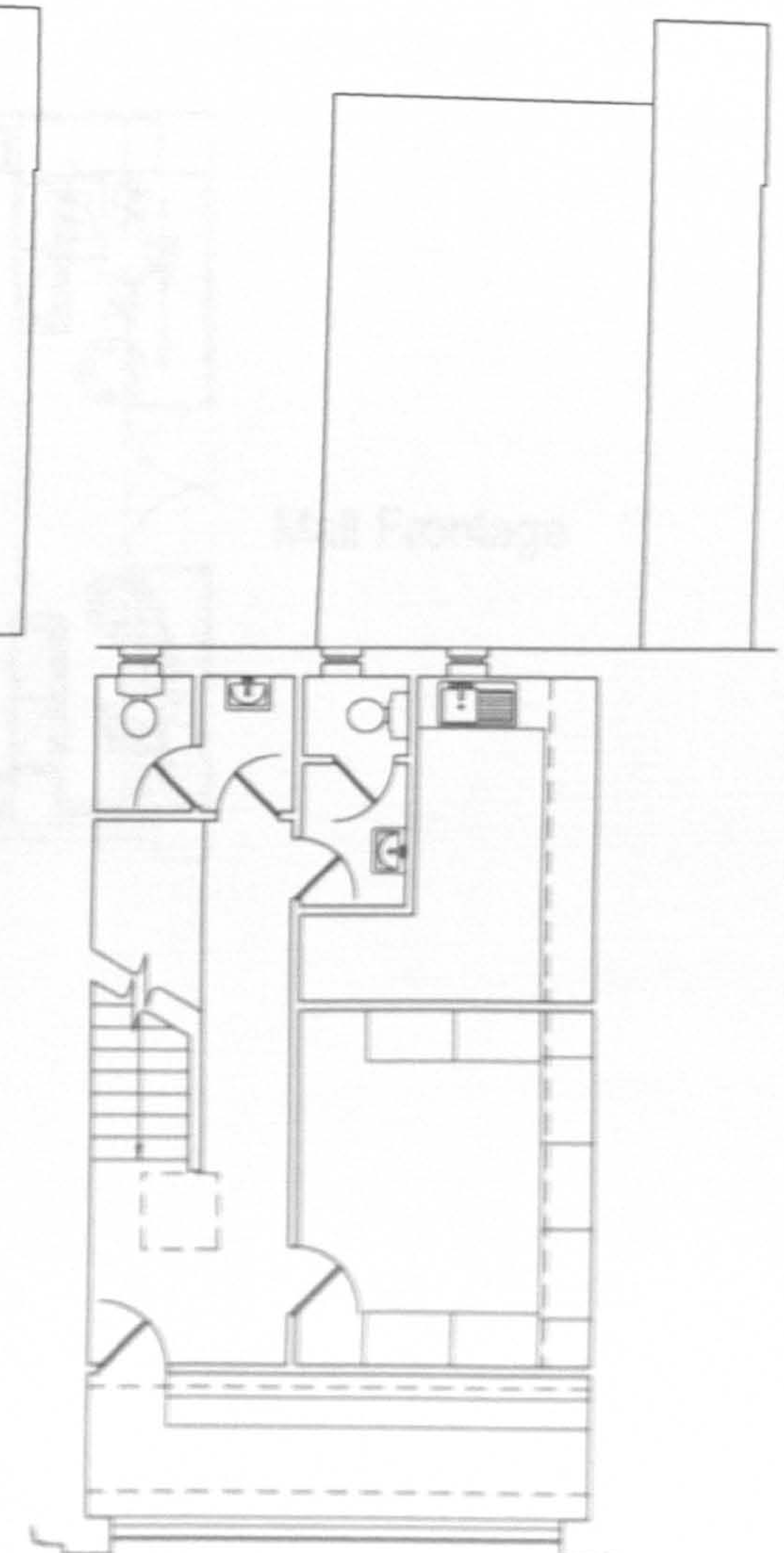


Street Frontage

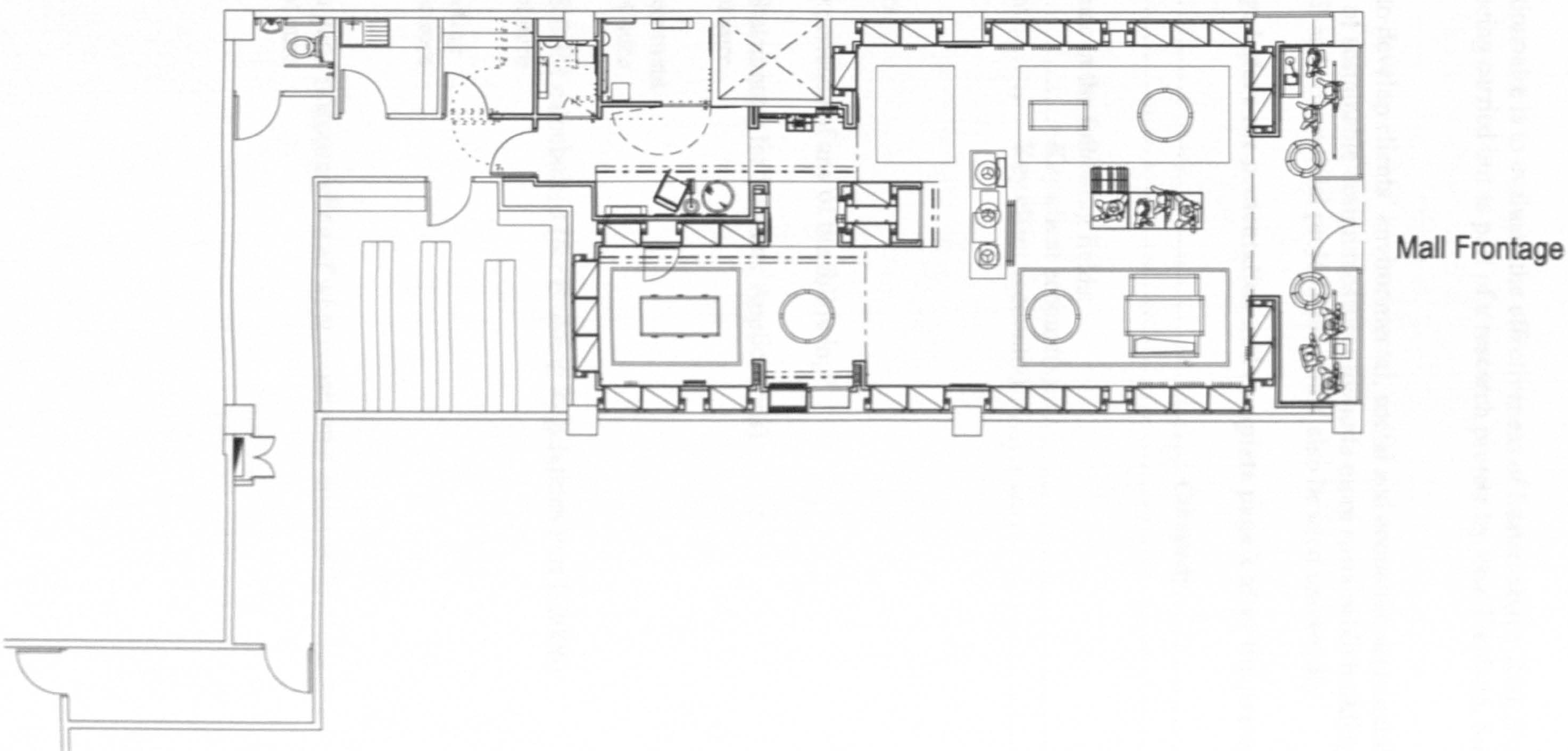
Ground Floor Plan



First Floor Plan



Second Floor Plan



Case Study 10

Sustainability Risk Management Matrix: Evaluation Questionnaire

The purpose of this questionnaire is to evaluate the effectiveness of Sustainability Risk Management as a design tool. This is being carried out as part of a research project by Rosi Fieldson, Simons Design.

SRM has been designed to develop clients' environmental, social and economic sustainability briefing and ensure incorporation of sustainable design measures towards more sustainable buildings. It is aimed specifically at retail and commercial projects but could also be used universally.

Please complete this page before the presentation and complete page 2 after the presentation.

Name (optional).. Company..............................
Job title:..

Number of years experience in the following fields;
Architecture/|Design.................. Key client account(s)..
Construction/management......... Key client account(s)..

Please circle your answers;

1. Do you have project experience of any of the following?

a) Sustainability Statements_(for Planning Applications)
Yes No Not sure

b) BREEAM Assessment
Yes No Not sure

c) Energy use or S BEM calculations (for Building Regulations Part L 2006)
Yes No Not sure

d) Whole Life Costing
Yes No Not sure

2. Do you feel you have a good understanding of what constitutes sustainable design?
Yes No Not sure

Sustainability Risk Management Matrix: Evaluation Questionnaire

Please answer these questions after the presentation
The aim of this section of the questionnaire is to evaluate the effectiveness of SRM Matrix as a design tool. Please circle your answer or rating (from 1=weakest/least effective to 5=strongest/most effective)

General format
3. How well did you understand the methodology of Sustainability Risk Management?
1 2 3 4 5

4. How well are all the relevant issues related to sustainable design incorporated in the structure of the SRM matrix?
1 2 3 4 5

Sustainability risks
5. How effective are the listed headings for prompting design team and client discussion of sustainability risks?
1 2 3 4 5

Proposed actions (passive, active, proactive, industry leading)
6. How effectively does this section allow ranked design options to be developed for discussion with the client?
1 2 3 4 5

Related Issues
7. How effectively does this section allow the interconnection of design decisions to be understood by the client and design team?
1 2 3 4 5

8. How effective is this section at highlighting potential conflicts?
1 2 3 4 5

Design checks
9. How effective is assigning a specific target measurement to each sustainability risk in ensuring the design meets the client's sustainability brief?
1 2 3 4 5

10. How effective is the designation of a Period of Effect in ensuring a long term solution to the sustainability risk?
1 2 3 4 5

11. How effective is defining the environmental design philosophy of the selected solution to the project design?
1 2 3 4 5

Review
16. How effective is this as a method of tracking changing client requirement or design direction?
1 2 3 4 5

12. How effective is noting the inclusion of the SRM Matrix in O&M documentation as an aid to facilities management in a completed project?
1 2 3 4 5

Implementation
13. Please state what benefits you might anticipate from implementing the SRM Matrix in your projects;
....
....
....
....
....
....

14. Please state what barriers you perceive might prevent the SRM Matrix being usefully implemented in your projects;
....
....
....
....
....
....
....

15. Do you have any projects that you believe could start using the SRM Matrix in the near future?
Yes No Possibly

16. Do you feel you have sufficient knowledge to act as a Sustainability Risk Manager for your projects?
Yes No With further training

17. To what extent does the SRM Matrix allow the incorporation of sustainability in retail design and construction?
1 2 3 4 5

18. How could the SRM Matrix be improved?
....
....
....
....
....
....
....

Thank you for your time in completing this questionnaire.

	Question number	1a	1b	1c	1d	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	AD 18	NS	N	N	N	Y	3	3	4	2	3	4	4	2	2	4	4	Clients awareness in importance of SRM matrix	Nature of specific project	Y	further training	4	By reviewing different projects for the SRM matrix
2	AD 19	NS	N	N	N	N	3	3	4	4	4	4	2	3	3	4	4	Public awareness long/short term financial gain	Financial	0	further training	0	backed up with data support
3	AD 20	Y	N	N	NS	y	4	4	4	5	3	3	4	5	4	4	3	Highlighting issues structure for review/discussion/implementation	costs perception	Y	Further training	4	financial impact, tax breaks. Optimum design with good tax breaks will give best value, service and customer satisfaction? +profit?
4	AD 9	NS	N	N	N	y	3	3	4	4	3	3	3	3	3	4	3	incorporating client knowledge of the environmental issues	lack of understanding of "cost" or life cost	Y	further training	3	more headlines case studies or options of headings of environmental considerations
5	AD	N	N	N	N	y	5	4	4	3	3	4	4	5	3	3	4	recording decisions made and why they have been implemented or discounted.	knowledge of options	Y	further training	4	0
6	AD	N	N	N	N	y	4	3	2	3	2	2	4	4	4	4	4	financial savings and green efficiency	client needs, clients may not know about available aspects so may not want to implement the unknown	P	further training	3	cost of the desired implications, predicted climate changes

7	AD15	N	N	N	N	NS	3	4	4	5	2	4	2	4	5	2	3	implementation can establish some key principles at design stages	being able to establish benefit at design stage and comparing against capital/revenue expenditure	P	further training	3	case studies need to be included
8	AD16	N	Y	N	N	Y	4	3	4	3	4	4	4	4	4	3	4	reduce clients WLC, reduce environmental impact, good marketing for Simons/clients	clients not receptive designers can't be bothered	Y	further training	4	by use! needs experience of team to understand all of the issues and benefits
9	AD 1	N	Y	N	N	Y	4	3	3	3	4	4	4	3	4	5	3	aid in determining a clearer brief from the client in what they want to achieve	limited knowledge	N	further training	4	0
10	AD 30	Y	N	Y	Y	Y	5	4	4	4	4	4	4	4	4	3	2	audit trail, client involvement, back up to policy	understanding, costs	Y	y	4	using colour to see at a glance how green and what is not fully mitigated
11	AD20, CM10	Y	Y	Y	Y	Y	5	4	4	4	3	3	4	4	4	3	5	customer focused, improvements from job to job	knowledge	N	y	4	focus groups/knowledge bases for principle subject groups
12	AD28	N	Y	N	Y	N	4	4	4	4	3	3	4	4	3	4	4	improve local authority dialog	lack of indication of potential cost benefits	P	n	3	indicate potential cost benefit
13	PM 19	N	N	N	Y	NS	4	3	4	3	4	0	2	4	3	3	2	marketing with local authorities, satisfying CABE or equivalent, marketing for tenants or funds lifecycle costing	cost, difficult to indicate benefits, customers difficult to persuade	Y	n	4	links to case studies/data
14	CM32	N	N	N	Y	N	3	3	3	3	3	4	3	3	3	3	2	demonstrating CSR of Simons group	perception of cost of implementation	P	n	3	simplicity of language
15																				7 yes	9 n		

Sustainability Risk Management Matrix

Project:	
Sheet number:	
Inception date:	
Revisions:	

Client's Policy Statement:

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Environmental considerations												
Co2 output												
Lighing												
Heating												
Cooling												
Small power												
other												
waste management												
materials												
external envelope												
interior fit-out												
Water use												
sanitary												
other processes												

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Rainwater run-off												
roof level												
street level												
Transport												
staff												
customer												
general impact												
Local environmental impact												
Light Polution												
Localised biodiversity												
Construction phase: Energy Management												
Construction phase: Waste Management												
Change phase: Waste management												
Social considerations												
Historical impact												
Cultural impact												
Design quality												

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Retail amenity												
Employment												
Noise												
Visual												
Traffic												
Community links												
Safety/securiy												
Construction phase : Noise												
Construction phase: Traffic												
Change phase: tenant/visual Amenity												
Economic considerations												
Maintenance costs												
Servicing costs												
Tenant Need and turnover												
Change phase:												

Sustainability Risk Management Matrix

Project:	Retail Shell Development	**Client's Policy Statement:**
Sheet number:	1	Carbon footprint required for promotional purposes by developer
Inception date:		
Revisions:		

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Environmental considerations												
Co2 output shared areas	50+% reduction	30-50% reduction	25-30% reduction	20% reduction to meet Part L 2006				standard kWH/m2?				
Lighting			reduce electrical load by specification									
Heating			exceed fabric U values, particularly at windows and doors									
Cooling			Limit any need by design of façade and windows for good natural ventilation									
Small power							mostly CCTV requirements					
microgeneration	Natural gas CHP	possible wind turbine site roof of unit 7	roof level PV possible using roof covering or integrated cells	no micro generation			management company required		5 years to technical review, 25 year warranty on equipment	technical		
Co2 output tenants	50+% reduction	30-50% reduction	25-30% reduction	20% reduction to meet Part L 2006		Reduction based on assumed loads. Tenants design to be approved by developer						
Lighing			encourage natural daylight where possible in large units				limited by tenant requirements					Tenant Design

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
Heating			exceed values, particularly at windows and doors	meet part L fabric U values and air tightness								Tenant Design
Cooling			limit over heating shop fronts by orientation and shading									Tenant Design
Small power		Allow for tenants to install own PV where appropriate on roof level plant areas										Tenant Design
Co2 output Housing	50+% reduction	30-50% reduction	25-30% reduction	20% reduction to meet Part L 2006		Reduction based on assumed loads. Tenants design to be approved by developer		Ecohomes standard?				
Lighing			Maximise daylighting to loss and gains	meet Part L installation criteria			limited by tenant requirements					
Heating	purchase from CHP		exceed values, particularly at windows and doors	meet part L fabric U values and air tightness			management required if CHP					
Cooling	purchase from CHP	heat recovery system to include cooled air	window design to avoid over heating and maximise natural ventilation.				Many units have single aspect, cross ventilation design required.Demand may rise for tenants own portable air-con, can this be managed?					
hot water	purchase from CHP		allow roof mounted solar hot water collection by tenants				roof mounted HW may be difficult to control					

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
Small power				meet intallations requirements								
microgeneration	CHP generated energy, heating and cooling bought by tenants		allow roof mounted PV and solar hot water collection by tenants			tenant interest may increase in near future	management company required if					
waste management		provide additional managed separation scheme at service charge to tenants	Provide additional separation and collection areas	meets local authority collection provisions			management company required, limited space available		ongoing review	human action		
shared areas			managed scheme	meets local authority collection provisions								
retail tenants areas			Additional shared recycling facility to be provided	tenants to manage own waste internally using sendback/delivery								
Housing tenants			Additional shared recycling facility to be provided	meets local authority collection provisions								
materials	recycled / recyclable materials	reduce transport energy	reduce environmental impact									
commercial external envelope		local suppliers	Ecopoints A rating	meet local authority material palate		mostly local/traditional facing materials	steel and concrete construction cannot be avoid					
housing external envelope		local suppliers	Ecopoints A rating			timber frame construction						
interior fit-out			encourage Ecopoints A rating									

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
Water use			reduce mains intake									
shared areas		collect rainwater for management suite WC	low use fittings									
Large retail units and cinema with public toilet provision		Allow rainwater collection by tenant and storage at high level	request low use fittings									Tenants design
Other retail units and A3		Allow rainwater collection by tenant and storage at high level	request low use fittings									Tenants design
Housing		Collect rainwater for use in flats	specify low use fittings									
landscaping		Collect rainwater for use at roof level and ground level	low water requirement plant species	requirement for watering roof level planting								
Rainwater run-off												
roof level			some water to be retained for use									
street level			permeable paving where appropriate									
Transport			green transport plan to be initiated	To LA requirements								
staff												
customer												
general impact												

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
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Rainwater run-off												
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street level			permeable paving where appropriate									
Transport			green transport plan to be initiated	To LA requirements								
staff												
customer												
general impact												

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
Local environmental impact				environmental impact study to be undertaken								
Light Polution			dark skies standards to streel lighting	signage illumination to LA requirements								
Localised biodiversity				environmental impact study to be undertaken regarding Copse areas								
Construction phase: Energy Management		encourage tenants to follow	plan for reduction %	considerate constructors scheme			base rate figures for prelims to be obtained, % to be aspirational?					
Construction phase: Waste Management		encourage tenants to follow	plan for reduction %	considerate constructors scheme			base rate figures for prelims to be obtained, % to be aspirational?					
Change phase: Waste management												
Social considerations												
Historical impact				Proceed to LA planning requirements								
Cultural impact												
Design quality												
Retail amenity												
Employment												
Noise												
Visual												

Risk to Sustainabilty	Proposed action				Client selected	Related Issues		Design Checks			Review	
Traffic												
Community links												
Safety/securiy			design all areas to best practice standards	CCTV coverage to link to local Police?								
Construction phase : Noise				CCS								
Construction phase: Traffic				CCS								
Change phase: tenant/visual Amenity			management strategy to ensure tenants hoarding standards (CCS required?)									
Economic considerations												
Maintenance costs			shell design to minimise external maintenance	To suit investor requirements								
Servicing costs				To suit investor requirements								
Tenant Need and turnover												
Change phase:												

Sustainability Risk Management Matrix

Project:	Shell for department store NE England
Sheet number:	1
Inception date:	
Revisions:	

Retailer's Policy Statement: Efficient use of energy and natural resources, commitmnet to highest environmental standards, reduce waste in construction and maintenance, use recycled materials where appropriate. BREEAM RATING REQUIRED.

Client's Policy Statement:BREEAM Rating excellent required.

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Environmental considerations												
Co2 output	50% reduction	40% reduction	35% reduction	meet Part L 2006 (25% reduction)		save running costs		Target kgCO2/m2/year or kWh/m2/year				
Microgeneration		Wind turbine (i.e. Vertical axis quiet revolution by XCO2 building integrated utilising fire escape stair towers structure)	Gas fired CHP unit to mananage heating and cooling	Low carbon supplier.	retailer to confirm	**Reduce overall load** to make renewables more effective part of energy needs	Need to have adequate heat dump for CHP. Need planning permission for turbines. Need survey for possible turbulance and wind available	Technical and financial feasability study needs to be carried out for wind/CHP.	5-25 years on equipment	Tecnocentric		Developer design to facilitate
Daylighting			sunpipes to deep plan areas, north facing roof light to sales floor, no backs on window beds		Active	staff will benefit	Cleaning and health and safety issues for roof lights and roof integrity/warrenty. Need to avoid solar gain heat loads		Building life	Climatic		Developer design to incorporate
Lighting			light responsive dimming, LED display lighting	High frequency ambient fittings, PIR switching	Active	LED cuts heat gain in display areas and fitting rooms		Lighting design target energy reduction by retailer		Tecnocentric		
Entrance management			all doors lobbied provided in shell		Active	staff will benefit		Airtightness test	Building life	Technocentric		Developer design to incorporate
Refridgeration Load			cold air retrival system to general cooling		Active							

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Cooling and heating	Ground source heat pump	Draw intake air though ground ducts to moderate intake temperature.	Displacement ventilation utilising opening lights at roof level		retailer to confirm		Air source has lower capital cost if piling is not part of substructure, needs feasability study			Tecnocentric/climatic		Developer design to facilitate or include to be agreed
Small power												
Shell Fabric				to meet part L 2006	Passive				Building lifetime			Developer design to incorporate
other			solar water heating facility		retailer to confirm		must ensure sufficent requirement for hot water, back up boiler still required			Climatic		Developer design to facilitate
waste management			Recycling facility for customers, store waste management area					volumes of waste	annual review	Anthropocentric		Developer design to incorporate
materials												
external envelope		recycled materials	GGS(3) A rating specification, reduce volumes of materials		Active/ Proactive			80% of shell	Building lifetime	Ecocentric		Developer design to incorporate
interior fit-out			Omit ceiling for ventilation purposes (or grid baffle ceiling), no PVC in flooring			use partial ceilings to define key areas using recycled materials	concealment of cables, sprinklers etc needs to be dealt with.	Green Guide A rating				

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Fixtures and fittings			No MDF, recycle plastic shelving,									
Water use												
sanitary			low useage fittings, waterless urinals, rainwater flushing		Active			% mains water saved				
other processes			grey water reed beds as part of landscaping		Active		planning issues		Building lifetime	Climatic/ ecocentric		Developer design to incorporate
Rainwater run-off												
roof level			High level storage capcity		Active			% rainwater utilised	5-10 years	Climatic / technocentric		Developer design to facilitate
street level			car park areas to be percollating surface		Active				building lifetime	Technocentric		Developer design to incorporate
Transport			Green transport plan for staff and customers, cycle routes on to site		Active				regular review	Anthopocentric		Developer design to facilitate
Local environmental impact			impact assesment required for BREEAM Credits	impact assessment required for planning	Active				Building lifetime	Ecocentric		Developer design to incorporate
Light Polution			Car park lighting design to limit Light Pollution		Active		roof lights will add to light pollution (Signage by retailer to minimise LP)		10 years	technocentric		Developer design to incorporate

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Localised biodiversity			Landscaping scheme to include areas for appropriate planting		Active				annual review	Ecocentric		Developer design to incorporate
Construction phase: Energy Management			Green travel plan for contractor, low carbon site management plan		Active					Anthropocentric		Required at tender stage
Construction phase: Materials			GGS (3) A ratings throughout		Active					Ecocentric		Required at tender stage
Construction phase: Waste Management			BRE SMARTWaste tools or superior system		Active	Shell Design for waste limitation				Anthropocentric		Required at tender stage
Social considerations												
Historical impact				no significant impact on this site	Passive	BREEAM points to be gained						Developer design to incorporate
Cultural impact				no significant impact on this site	Passive	BREEAM points to be gained						Developer design to incorporate
Design quality			good design to be demonstrated		Active	Landmark site?						Developer design to incorporate
Retail amenity				impact analysis required for planning application	Passive							
Employment				impact analysis required for planning application	Passive							

Risk to Sustainabilty	Proposed action				Client Selected	Related Issues		Design Checks			Review	
	Industry Leading	Proactive	Active	Passive		Positive	Negative	Measurement	Period of effect	Philosophy	Revision notes	Residual Risks and responsible party
Noise				no significant impact on this site	Passive	BREEAM points to be gained						
Visual				no significant impact on this site	Passive	BREEAM points to be gained						
Traffic			green transport plan to suit BREEAM credits		Active							
Community links							Needs consideration as this is an edge of town site					
Safety/securiy				Car parking and pedestrian access to meet PARK MARKTM (BREEAM credits available)	Passive							Developer design to incorporate
Construction phase : Noise				CCS or similar site management scheme	Passive							
Construction phase: Traffic				CCS or similar site management scheme	Passive							
Economic considerations												
Maintenance costs			Recommend Whole life costing of all GGS (3) A rating materials use in shell		Active			Capital cost to be equal	Agreed maintenance period with retailer?	technocentric		Developer design to incorporate
Servicing costs				Microgenerati on servicing costs to be considered	Passive					Technocentric		Developer design to facilitate